NATUR VÅRDS VERKET

The economic value of environmental change in Sweden

A survey of studies

Includes extended summary in Swedish

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The economic value of environmental change in Sweden

A survey of studies

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Foreword

This survey of studies and associated database on the economic value of environmental change in Sweden is an updated and extended version of the study carried out by Tore Söderqvist in 1996. Its main objective is to support the Swedish Environmental Protection Agency (SEPA) in its work on Regulatory Impact Assessments (RIAs). The cost-effectiveness of policy and project proposals is an important aspect of the RIAs, but there is also an increasing demand for analyses that take into account the environmental benefits of such proposals. However, undertaking economic valuation studies of environmental change is both costly and time consuming. The provision of a database of valuation studies will therefore greatly facilitate the use of monetary values of environmental benefits in analytical work and as a means to support decision making.

The main text of this report presents the database and describes how the data were collected. It also draws out some general conclusions about the surveyed valuation studies. This text is also available in Swedish (”Sammanfattning”). There are three additional outputs:

1) A bibliography of the valuation studies (Appendix 1 of this report),
2) Summaries of the valuation studies (Appendix 2 of this report),
3) A database of valuation studies, which is available for downloading as an Excel sheet from www.beijer.kva.se/valuebase.htm

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All responsibility for the report lies with the authors.

March 2004
Swedish Environmental Protection Agency

Contents

Sammanfattning

(Summary in Swedish)

Bakgrund

Denna sammanställning av ekonomiska värderingsstudier av miljöförändringar i Sverige är en uppdatering och vidareutveckling av den studie som gjordes av Tore Söderqvist 1996. Sammanställningen avser bl.a. att stödja verkets arbete med att genomföra samhällsekonomiska konsekvensanalyser. Naturvårdsverket har krav på sig att göra kostnadseffektivitetsanalyser av de förslag som läggs fram men efterfrågan på analyser där kostnaden ställs i relation till den miljönytta de bidrar till ökar också. Det är resurskrävande att göra monetära värderingar av miljöeffekter, både ur ett tids- och kostnadsperspektiv. Genom att ha tillgång till en uppdaterad sammanställning av värderingsstudier ökar möjligheterna för Naturvårdsverket och andra intressenter att utnyttja värderingsresultat i de beslutsunderlag som tas fram.

Huvudtexten i denna rapport presenterar databasen och beskriver hur data har samlats in, samt redovisar några allmänna resultat kring värderingsstudierna. Denna text finns även översatt till svenska under rubriken ”Sammanfattning”. Utöver detta har uppdraget resulterat i tre produkter:

1) En bibliografi över värderingsstudier (bilaga 1 till denna rapport).
2) Sammanfattningar av värderingsstudier (bilaga 2 till denna rapport).
3) En databas för värderingsstudier, vilken finns tillgänglig för nedladdning i form av en Excel-fil från www.beijer.kva.se/valuebase.htm

Uppdraget har genomförts av Tore Söderqvist och Sara Sundberg vid Beijerinstitutet. Författarna ansvarar själva för innehållet.

Inledning

Antalet empiriska studier avseende det ekonomiska värdet av miljöförändringar har ökat snabbt under de senaste 20 åren. Flera olika metoder för att värdera miljöförändringar finns att tillgå – en lista över dessa finns längre fram i denna rapport. För detaljer om metoderna hänvisas läsaren till Freeman (2003), som ger en grundlig och teoretiskt avancerad framställning av metoderna och hur de är rotade i ekonomisk välfärdsteori. Mindre avancerade framställningar ges av t.ex. Brännlund och Kriström (1998), Perman et al. (2003) och Söderqvist et al. (2004). Det ökande antalet värderingsstudier kan återspegla ett alltmer allmänt synsätt att det är viktigt och relevant att beakta miljön även i ekonomiska analyser. Sålunda har t.ex. Carson (2004) sammanställt en bibliografi över mer än 5000 värderingsstudier från fler än 100 länder. Även i Sverige har det gjorts allt flera försök att värdera miljöförändringar ekonomiskt. För drygt 10 år sedan gjorde Kriström (1992) en sammanfattning av ungefär ett dussin svenska värderingsstudier. Den senaste någorlunda

heltäckande översikten över svenska värderingsstudier publicerades fyra år senare (Söderqvist 1996). I denna sammanfattades ungefär 60 sådana studier.

Denna rapport är resultatet av ett projekt vars syfte var en grundlig uppdatering av översikten från 1996. Ett annat resultat av projektet är en databas, som innehåller detaljerade uppgifter om varje värderingsstudie. Vi hoppas att detta projekt kommer att göra det lättare att ta del av de fakta som finns i svenska värderingsstudier, och därigenom resultera i följande fördelar:

- Ökade möjligheter att använda resultat av värderingsstudier i kostnadsnyttoanalyser (”cost-benefit analyses”, CBA) och andra verktyg för beslutsfattande.
- Ökad kunskap om metodframsteg inom ekonomisk värdering.
- Undvikande av onödiga upprepningar av värderingsstudier.
- Stöd för generalisering av skattade ekonomiska värden med hjälp av någon procedur för överföring av skattningar till nya omständigheter (”benefit transfer”). Sådana generaliseringar måste för övrigt göras med stor försiktighet, se t.ex. Brouwer och Spaninks (1999).
- Underlätta upprättande av nätverk mellan personer som är intresserade av ekonomisk värdering av miljön.
- Ökade möjligheter att dra allmänna slutsatser om det ekonomiska värdet av miljöförändringar, och att utföra metaanalyser av värderingsresultat.
- Underlätta integrering av svenska värderingsresultat i internationella databaser såsom EVRI (The Environmental Valuation Reference Inventory, se www.evri.ca).

Den här rapporten är strukturerad på följande vis: Projektet, inklusive proceduren för datainsamling och resultat, beskrivs i avsnitt 2. Databasen beskrivs i detalj i avsnitt 3. I avsnitt 4 finns statistik om värderingsstudierna i databasen. I avsnitt 5 görs några avslutande anmärkningar.

Projektet

Projektarbetet utfördes under perioden augusti till december 2003. För att samla in värderingsstudier skickades en förfrågan per post till 106 svenska organisationer i slutet av augusti 2003. Dessa organisationer inkluderade svenska universitet och högskolor, forskningsinstitut, myndigheter och konsultföretag. Dessa ombads att rapportera om de hade utfört någon värderingsstudie sedan 1996, då den senaste sammanställningen av svenska värderingsstudier gjordes. Vi letade också efter värderingsstudier i olika litteraturdatabaser och på Internet, och genom kontakter med svenska miljöekonomer.

Sökandet efter värderingsstudier begränsades till empiriska studier som syftade till ekonomisk värdering av någon miljöförändring i Sverige. Miljöförändring är ett brett begrepp som kan omfatta sådant som förändringar av miljöns kvalitet och förändringar av miljöns/naturens/ekosystemens tillhandahållande av varor och tjänster. Vi har också tagit med värderingsstudier avseende förändringar av hälsorisker i de fall då sådana förändringar orsakades av någon miljöförändring, t.ex. utsläpp av föroreningar.

En annan begränsning av sökandet efter värderingsstudier avser den typ av data som använts i studierna. Fyra olika kategorier av värderingsstudier kan urskiljas:

1. Studier som bygger på nya (primär-) data – dessa studier kallas i det följande för ”primärstudier”.
2. Studier som syftar till att generalisera tidigare skattningsresultat och andra värderingsstudier som bygger på sekundärdata, dvs. data som insamlats av tidigare primärstudier. För dessa studier använder vi i det följande benämningen ”sekundärstudier”.
3. Studier som utfört en meta-analys. Sådana ”metastudier” använder sig av ett sammanslaget datamaterial bestående av primärdata från tidigare studier.
4. Studier som sammanfattar resultaten av tidigare värderingsstudier. Dessa studier kallas i det följande för ”översikter”.

Huvudsyftet med projektet var att samla in primärstudier, men sökandet efter primärstudier ledde också till en bifångst av sekundärstudier, metastudier och översikter. Vi har förmodligen lyckats finna de flesta primärstudier som utförts i Sverige, men givetvis finns det ett antal primärstudier som fortfarande saknas. Det var särskilt svårt att hitta studier som utförts av konsultfirmor och studier i form av examensarbeten vid universitet och högskolor. Sådana typer av studier kan därför vara underrepresenterade i vår sammanställning.

Projektet har lett till tre huvudresultat:

1. En *bibliografi* som innehåller alla insamlade värderingsstudier. Denna bibliografi utgör bilaga 1 till denna rapport, och omfattar såväl primärstudier som de sekundärstudier, metastudier och översikter som vi påträffade.
2. Primärstudierna sammanfattades, och *en lista med sammanfattningar* utgör bilaga 2 till denna rapport.
3. Alla undersökningar som ingår i bibliografin fördes in i ett Excel-dokument för att skapa en *databas* benämnd ValueBase^{SWE} (Valuation study database for environmental change in Sweden). Denna databas kan laddas ned från www.beijer.kva.se/valuebase.htm.

Genom att använda Excel-kommandona ”sök” eller ”sortera”, kan man lätt leta i databasen efter t.ex. studier från ett speciellt år, eller av en viss författare, eller för studier som tillämpat en viss värderingsmetod. Den information som samlats in om studierna i databasen förklaras närmare i nästa avsnitt. Slutligen bör det påpekas att vi inte bedömt studiernas kvalitet innan vi tog med dem i bibliografin, listan med sammanfattningar och databasen. Detta innebär att vissa av de studier som har inkluderats kan ha brister avseende exempelvis värderingsmetodiken.

Databasen

När detta skrivs innehåller databasen ValueBase^{SWE} information om 170 värderingsstudier av miljöförändringar i Sverige. Som nämndes i det föregående avsnittet, ingår såväl primärstudier som sekundärstudier, metastudier och översikter i databasen. Detaljerad information om studierna registrerades dock endast för pri-

märstudierna. Den information som registrerats för de andra typerna av studier är begränsad till informationen i bibliografin i bilaga 1.

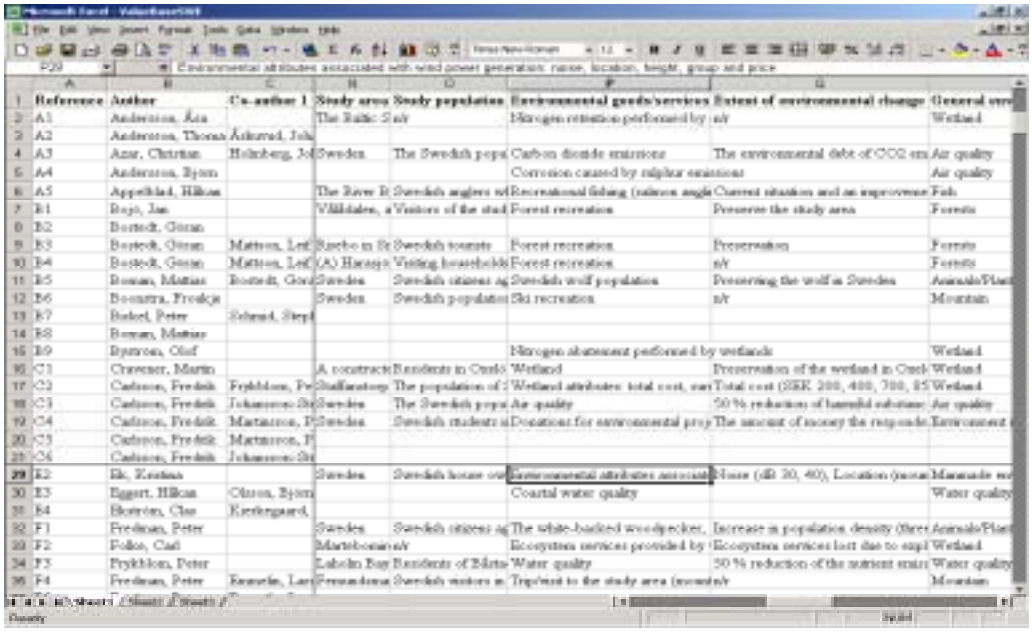
Databasen EVRI

När vi bestämde vilken information som skulle ingå i ValueBase^{SWE}, användes Environmental Valuation Reference Inventory (EVRI) som en modell. EVRI har utvecklats av Environment Canada och är en sökbar databas för empiriska miljövärderingsstudier. Den kan nås via Internet (www.evri.ca). EVRI bygger på att värderingsstudier registreras i ett strukturerat formulär, så att samma slags information ingår för alla registrerade studier. På så sätt underlättas generaliseringar av värderingsskattningar.

Det finns sex huvudkategorier av information i EVRI: referens till studien, geografiskt undersökningsområde, populationskarakteristika, värderad miljöaspekt, värderingsmetod, skattade värden och sammanfattning (Navrud och Vågnes 2000). Varje kategori består av ett antal fält där data registreras, och det krävs att data registreras i minst 12 specificerade fält för att registreringen skall bli giltig. För att underlätta en eventuell framtida integrering av svenska värderingsstudier i EVRI, tog vi hänsyn till dessa obligatoriska fält när vi konstruerade databasen. I ValueBase^{SWE} finns information om studierna i form av 30 fält, som beskrivs nedan.

Datafält i ValueBase^{SWE}

Figur 1 ger en glimt av hur ValueBase^{SWE} ser ut när Excel-dokumentet öppnas. Värderingsstudierna visas som rader på kalkylbladet (blad 1, Sheet1), och varje kolumn representerar en viss typ av information om studierna. På blad 2 (Sheet2) finns en lista över förkortningar som används i databasen. All information i databasen är på engelska.



Figur 1. ValueBase^{SWE}

Varje studie tilldelades ett referensnummer (*Reference number*, kolumn A), ordnade enligt begynnelsebokstaven i (den första) författarens efternamn. Publikationer-

na har markerats med detta referensnummer, och finns för närvarande i en speciell sektion av Beijerinstitutets bibliotek.

Bibliografisk information om varje studie finns under rubrikerna *Author* (B), *Co-author* (C-E), *Year* (F), *Title* (G), *Document type* (H) och *Source of study* (I). Författarens namn och namnet på högst tre medförfattare uppges. *Year* avser året för publicering. Studierna har kategoriserats i följande sju dokumenttyper:

1. journal (tidskrift)
2. report (rapport)
3. doctoral thesis (doktorsavhandling)
4. licentiate thesis (licentiatavhandling)
5. thesis (t.ex. examensuppsats, D-uppsats eller C-uppsats)
6. conference paper (konferensuppsats)
7. chapter in book (bokkapitel)

Studierna har klassificerats i fältet *Type of study* (J) som primärstudier, sekundärstudier, metastudier eller översikter. Studier som har använt både primärdata och sekundärdata har klassificerats som primärstudier.

I nästa fält, *Relation to other studies* (K), rapporteras referensnumret för relaterade studier. Ett exempel på information i detta fält är referensnummer för uppföljande studier eller för översikter i vilka information om studien också finns. Om resultatet från en värderingsstudie publicerats mer än en gång, anges den senast publicerade referensen. I detta fall finns information om de tidigare publicerade studierna i fältet *Relation to other studies.*

Den ovan beskrivna informationen (kolumnerna A-K) anges för alla värderingsstudier. I de återstående fälten har endast information om primärstudier registrerats. Först nämns vilken värderingsmetod som har tillämpats (*Valuation method*, L). Följande förkortningar har använts:

1) Metoder baserade på faktiskt marknadsbeteende (“revealed preferences methods”, RP):
   1.1. Produktionsfunktionsmetoden (“the production function method”, PF)
   1.2. Resekostnadsmetoden (“the travel cost method”, TCM)
   1.3. Fastighetsvärdemetoden (“the hedonic price method”, HP)
   1.4. Skyddsutgiftsmetoden (“the defensive expenditure method”, DE)

2) Scenariometoder (“stated preferences methods”, SP):
   2.1. Scenariovärderingsmetoden (“the contingent valuation method”, CVM)
   2.2. “Choice experiments” (CE)
   2.3. “Choice modelling” (CM)

3) Andra värderingsmetoder (inte lika fast rotade i välfärdsteori):
   3.1. Humankapitalmetoden (”the human capital method”, HCM)
   3.2. Kostnaden för att verkställa politiska beslut (politisk betalningsvilja, ”political WTP”)

3.3. Andra kostnadsbaserade metoder: ersättningskostnader (”replacement costs”, RC) och restaureringskostnader (”restoration costs”, REC)[1].

Ytterligare information om värderingsmetoden anges i fältet *Specification of the valuation method* (M). Typ av undersökningsmetod och typ av frågor är exempel på information som ingår i detta fält. I fältet *Study area* (N) lämnas information om vilket geografiskt område/belägenhet som studien gäller. Nästa fält innehåller information om vilken population som har studerats (*Study population*, O).

Fyra fält används för att beskriva den miljöförändring som värderas i studien. Fältet *Environmental goods/services* (P) beskriver den vara, tjänst eller kvalitet som enligt studien har värderats. I följande fält, *Extent of environmental change* (Q), registreras information om storleken på den miljöförändring som värderas i studien. Miljövarorna/-tjänsterna sorteras därefter i kategorier på två olika sätt. I fältet *General environmental asset* (R) klassificeras de värderade varorna och tjänsterna enligt det ekosystem/den miljöresurs som tillhandahåller dem. Exempelvis registreras ”skog” i detta fält för en värderingsstudie som har skattat det ekonomiska värdet av rekreation i skogar. På liknande vis har ”våtmark” registrerats om exempelvis en våtmarks kapacitet som kvävefälla har varit föremål för värdering.

I det sista av de fyra fält som används för att kategorisera miljövarorna/-tjänsterna sorteras studierna enligt de svenska miljökvalitetsmålen *(Environmental quality objectives,* S). År 1999 fastställde riksdagen 15 miljökvalitetsmål. I dessa beskrivs mål för en hållbar utveckling av olika delar av miljön i Sverige. Värderingsstudierna har klassificerats utifrån hur de anknyter till dessa mål. Observera att två eller flera ekosystem/miljöresurser respektive två eller flera miljökvalitetsmål har registrerats för varje värderingsstudie som har varit tillräckligt bred för att gälla mer än ett ekosystem/miljöresurs eller mer än ett mål.

Informationen om miljövaror/-tillgångar följs av av tre fält avseende det stickprov som studien har använt sig av: *Sample size* (T), *Sampling* (U) och *Response rate* (V). Stickprovsstorleken definieras som bruttostorleken, med andra ord storleken före justeringar för exempelvis avflyttningar och dödsfall. I *Sampling* beskrivs hur stickprovet har gjorts från populationen. Svarsfrekvensen definieras som antalet svar delat med stickprovets nettostorlek.

Det följande fältet, *Year of data* (W), avser det år då data insamlades. Om det ekonomiska värde som rapporterats i studien har diskonterats i syfte att återspegla ett annat år, registreras istället detta år i fältet *Year of data*. Nästa fält innehåller information om betalningsinstrument (*Payment vehicle*, X). Detta används endast för studier som har använt någon scenariometod. I fältet *Economic measures* (Y) registreras vilket ekonomiskt välfärdsmått som studien har skattat, exempelvis betalningsvilja (”willingness to pay”, WTP), vilja att acceptera kompensation (”willingness to accept compensation”, WTA), konsumentöverskott (”consumer surplus”, CS), marginellt konsumentöverskott (”marginal consumer surplus”, MCS), ekvivalent variation (”equivalent variation”, EV), kompenserande variation (”compensating variation”, CV) och producentöverskott (”producer surplus”, PS). I detta fält rapporteras också de statistiska mått relaterade till skattade värden, t.ex. medelvärde, median och konfidensintervall, som eventuellt har angivits i studien.

[1] Se Sundberg (2004) beträffande villkor för att ersättningskostnadsmetoden skall leda till giltiga skattningar av ekonomiska värden.

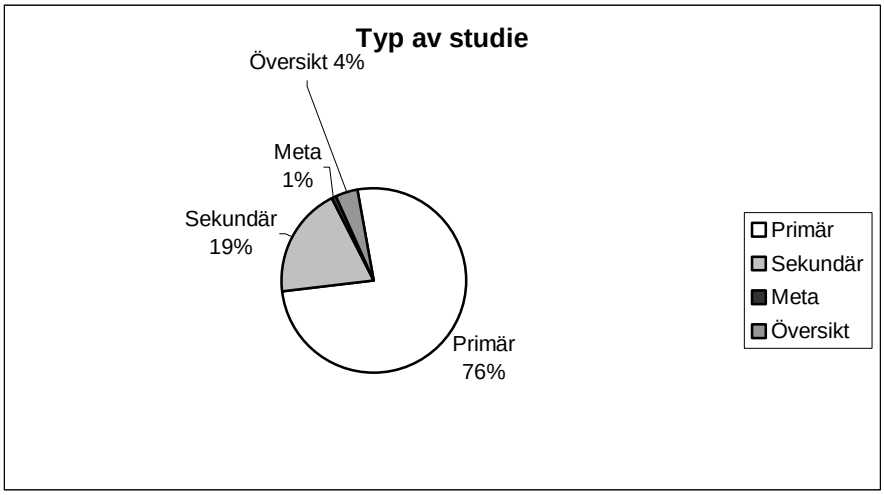
I nästa fält rapporteras skattade värden (*Estimated values,* Z). Värdena anges i kronor per person, om inget annat uppges. Observera att värdena rapporteras så som de angetts i värderingsstudien. De har alltså inte omräknats till något basår, vilket innebär att det inte utan omräkning går att jämföra värden från olika studier.

I fältet *Valuation function* (AA) rapporteras om en värderingsfunktion finns i studien. Information om den beroende variabeln och de förklarande variablerna registreras i fältet *Specification of the valuation function* (AB). Om det framgår av studien att dess resultat använts i en kostnads-nyttoanalys, eller för policy-beslut, rapporteras detta med ett ”ja” i fältet *Used in CBA/policy* (AC). Det sista fältet används för eventuella kompletterande anmärkningar (*Remarks,* AD).

Observera slutligen att tidsbrist medfört att det återstår att sammanfatta några studier. Dessa anges med tecknet ”*” i fältet *Relation to other studies* (K). Vidare används ett frågetecken för att ange att information om ett specifikt fält inte finns i studien. Observera att endast sådan information som finns i studierna har registrerats i databasen. Vi har med andra ord inte försökt att lägga in egna tolkningar när information saknats. Dessutom har de beteckningar som använts i studierna följts så långt detta varit möjligt. Det bör också nämnas att alla fält inte är relevanta för alla värderingsstudier, t.ex. på grund av den värderingsmetod som tillämpats. Om ett fält inte är relevant, anges detta med ”n/r”.

Lite statistik

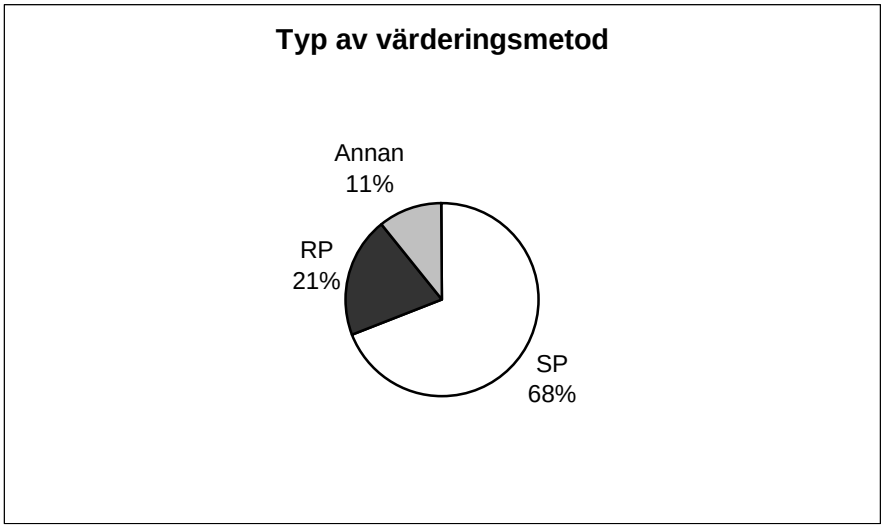
Databasen innehåller information om drygt 100 primärstudier. I figur 2 visas fördelningen av studier mellan primärstudier, sekundärstudier, metastudier och översikter.



Figur 2. Typ av studie

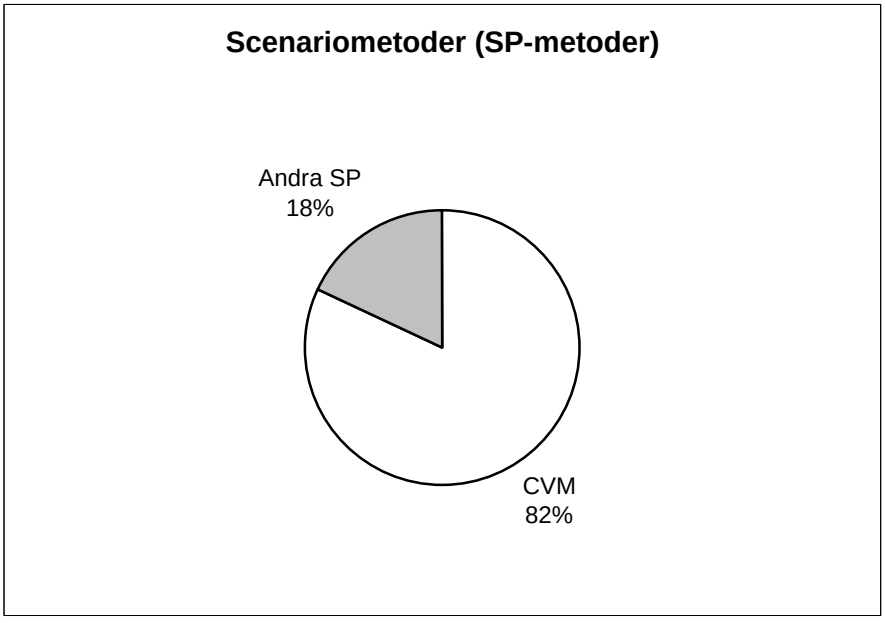
I figur 3 visas vilka huvudmetoder för värdering som använts i primärstudierna, jfr listan i avsnitt 3.2. Nära 70 procent av studierna har använt scenariovärderingsmetoden (CVM) eller någon annan SP-metod. I ca 20 procent av studierna har någon

RP-metod tillämpats, och i ca 10 procent har någon annan värderingsmetod använts.



Figur 3. Typ av värderingsmetod

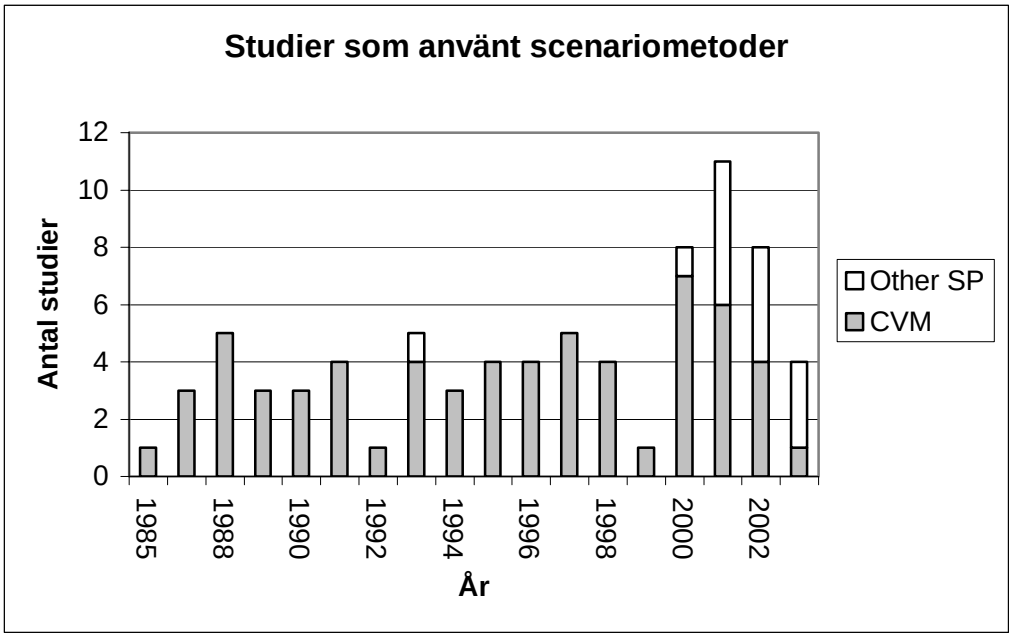
Vilken är den populäraste SP-metoden? I figur 4 visas att det är scenariovärderingsmetoden (CVM), som tillämpats av 82 procent av SP-studierna. De metoder som benämns ”andra SP” i figur 4 är ”choice experiments” eller liknande metoder, vilka bygger på respondenters val mellan flera olika scenarier.



Figur 4. Scenariometoder

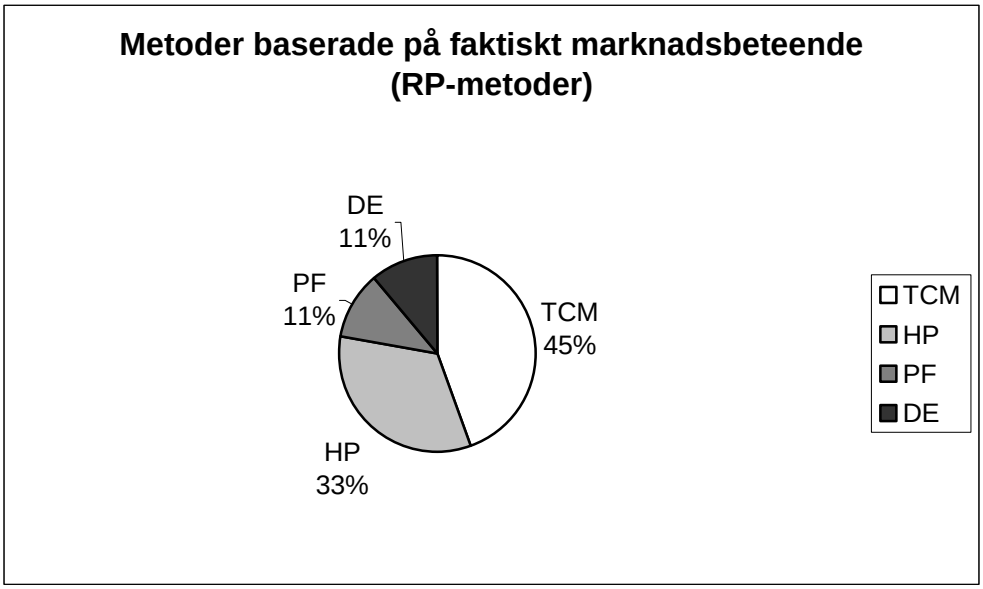
Den tidigaste CVM-studien som finns i databasen är Jan Bojös värdering av naturen i Vålådalen i Jämtlands län (Bojö 1985). Den första SP-studien i databasen,

som tillämpade en annan scenariometod än CVM, publicerades 1993 (Widlert et al. 1993). På senare år verkar det som om andra SP-metoder än CVM, i första hand ”choice experiments”, har ökat i popularitet. Se figur 5.



Figur 5. Användningen av scenariometoder över tiden

Den RP-metod som använts mest är resekostnadsmetoden, åtföljd av fastighetsvärdemetoden, se figur 6 nedan. De resekostnadsstudier som tagits med i databasen har huvudsakligen gällt rekreationsvärden förknippade med olika områden. Den första resekostnadsstudien i databasen publicerades 1982 (Hjalte 1982). Syftet med denna undersökning var att fastställa ett värde för vattenkvalitet och rekreation vid en sjö i sydöstra Sverige. Databasens tidigaste fastighetsvärdestudie är Thomas Hammars värdering av trafikbuller i Täby norr om Stockholm (Hammar 1974).



Figur 6. Metoder baserade på faktiskt marknadsbeteende (RP-metoder)

Primärstudierna har grupperats utifrån den miljövara eller -tjänst som de har värderat. Av tabell 1 framgår att de två största kategorierna är *miljö som skapats av människan* och *vattenkvalitet*. De flesta studierna i kategorin *miljö som skapats av människan* är studier av miljökostnader som uppstår till följd av olika typer av investering i infrastruktur, exempelvis värdering av trafikbuller eller en försämrad utsikt. Den näst största gruppen är värderingsstudier av *vattenkvalitet*. I denna grupp ingår studier av kvalitet hos både sötvatten och hav. I denna kategori ingår dock inte värderingsstudier av sportfiske; dessa har hänförts till kategorin *fisk*. *Skogar* och *luftkvalitet* är två andra kategorier, som också har varit föremål för värdering i tämligen hög grad. Dessutom har följande kategorier använts: *jordbruksmark, våtmarker, berg, djur/växter* och *miljö i allmänhet.* Det är viktigt att notera att flera miljövaror och -tjänster kan ha värderats i en och samma studie. Därför kan inte antalet värderingsstudier i tabell 1 läggas ihop för att få det totala antalet studier som ingår i sammanställningen.

Tabell 1. Värderingsstudier relaterade till ekosystem/miljöresurser

Ekosystem/miljöresurs	**Antal värderingsstudier**
Miljö som skapats av människan	32
Vattenkvalitet	20
Skogar	16
Luftkvalitet	16
Fisk	12
Jordbruksmark	7
Fjäll	6
Våtmarker	6
Djur/växter	4
Miljö i allmänhet	3

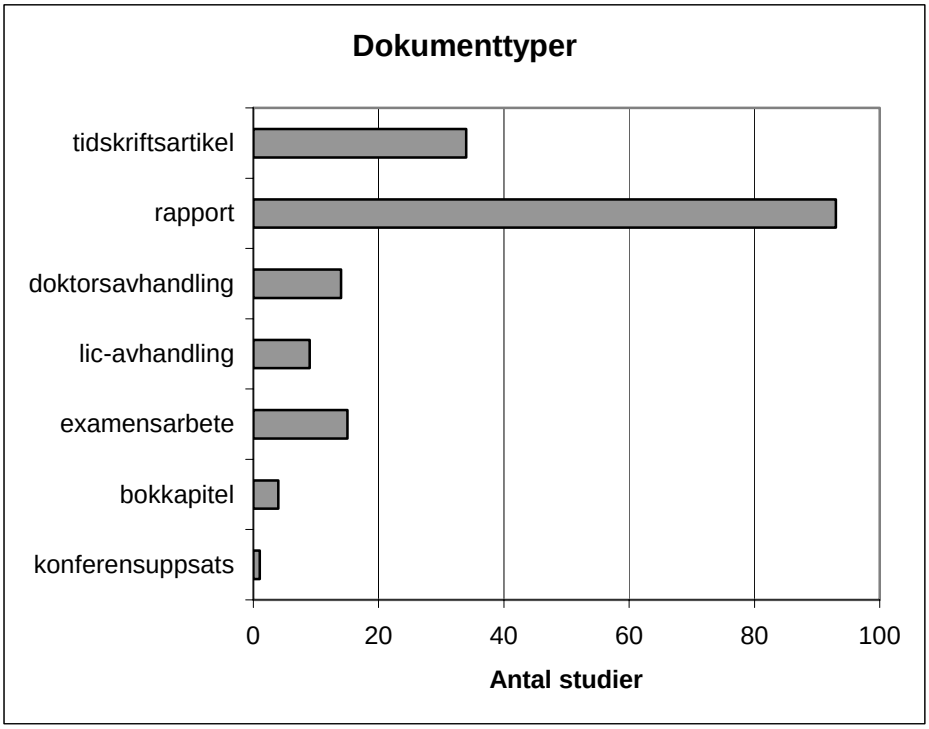
Vi granskade också hur primärstudierna är relaterade till de 15 svenska miljökvalitetsmålen. I tabell 2 visas det antal studier som har anknytning till vart och ett av de 15 målen. Observera att vissa studier är relaterade till två eller flera mål. Den största gruppen värderingsstudier återfinns för målet *god bebyggd miljö*. Andra stora grupper är: *levande sjöar och vattendrag, levande skogar* och *frisk luft*. Endast en värderingsstudie hade anknytning till vart och en av målen *begränsad klimatpåverkan* och *säker strålmiljö*, och ingen av studierna i vår sammanställning var relaterad till målet *skyddande ozonskikt*.

Tabell 2. Värderingsstudier relaterade till de 15 svenska miljökvalitetsmålen

Miljökvalitetsmål	Antal värderingsstudier
God bebyggd miljö	33
Levande sjöar och vattendrag	20
Levande skogar	19
Frisk luft	15
Ingen övergödning	9
Hav i balans, levande kust och skärgård	8
Ett rikt odlingslandskap	7
Myllrande våtmarker	6
Storslagen fjällmiljö	6
Giftfri miljö	3
Bara naturlig försurning	3
Grundvatten av god kvalitet	2
Säker strålmiljö	1
Begränsad klimatpåverkan	1
Skyddande ozonskikt	0

En annan intressant fråga är om värderingsstudier har använts i kostnadsnyttoanalyser, eller bidragit till att vägleda beslutsfattande på något annat sätt. Detta kan dock vara svårt att konstatera med utgångspunkt från den information som kan hämtas ur databasen. Om fältet *Used in CBA/policy* granskas, finner man att endast fem studier verkar ha ingått i en kostnads-nyttoanalys eller använts i beslutsfattande. Detta förvånar inte, eftersom kostnads-nyttoanalys för närvarande inte används särskilt mycket i Sverige (Frykblom och Helgeson 2002). Det skulle dock vara fel att utifrån informationen i databasen dra slutsatsen att mycket få värderingsstudier används i kostnads-nyttoanalyser eller i beslutsfattande, eftersom en sådan slutsats enbart skulle bygga på den information som faktiskt finns i studierna. Exempelvis kan de värden som framkommit genom primärstudierna i ett senare skede ha använts i en kostnads-nyttoanalys, eller utgjort grunden för utformning av en policy.

En i viss mån angränsande fråga är om svenska värderingsstudier huvudsakligen utförts inom den akademiska världen eller inte. Svaret synes vara att i Sverige dominerar den akademiska världen. I figur 7 visas antalet studier i varje kategori av dokumenttyp. De mest renodlade akademiska dokumenttyperna är vetenskapliga tidskrifter samt doktors- och licentiatavhandlingar. I dessa kategorier återfinns 34 procent av alla dokument. Dessutom ingår de flesta dokumenten i kategorin ”rapporter” i rapportserier utgivna av universitet eller akademiska forskningsinstitut.



Figur 7. Dokumenttyper

Slutkommentar

Det finns minst tre möjliga framtida utvidgningar av detta projekt, om finansiering och tid kan säkerställas. För det första hoppas vi att ValueBase^{SWE} skall kunna uppdateras inom en inte alltför avlägsen framtid. För det andra skulle ValueBase^{SWE} kunna utvecklas från ett enkelt Excel-dokument till en mer avancerad, webbaserad databas. För det tredje skulle databasen kunna integreras i internationella databaser, såsom EVRI.

Även om vårt syfte var att göra bibliografin, sammanfattningarna och databasen så fullständiga som möjligt när det gäller primärstudier, finns det naturligtvis studier som vi inte hittade. Vi avslutar därför denna rapport genom att be läsaren kontakta oss om han eller hon märker att det fattas någon studie. Information om studier som publicerats efter att vårt projekt avslutades är också mycket välkommen. Vi skulle också vara tacksamma för upplysningar om fel som kan finnas i bibliografin, sammanfattningarna och i databasen. Den eventuella förekomsten av fel och det faktum att vi inte bedömt studiernas kvalitet innebär att envar som skall använda sig av data som finns i sammanfattningarna eller i databasen alltid bör gå tillbaka till det ursprungliga dokument i vilket studien är publicerad.

Slutligen vill vi tacka Ulrika Lindstedt, Oskar Larsson och deltagarna i ett seminarium om ValueBase^{SWE} på Naturvårdsverket för värdefulla kommentarer och stöd, Anna Sjöström för utformningen av hemsidan, och Naturvårdsverket för finansieringen av detta projekt.

Acronyms and abbreviations

BG	Bidding game
CBA	Cost benefit analysis
CE	Choice experiment
CM	Choice modeling
CS	Consumer surplus
CV	Compensating variation
CVM	Contingent valuation method
DC	Discrete choice
DE	Defensive expenditure method
EV	Equivalent variation
HCM	Human capital method
HP	Hedonic price method
MBDC	Multiple bounded discrete choice
MCS	Marginal consumer surplus
MWTP	Marginal willingness to pay
OE	Open-ended
PC	Payment card
PF	Production function method
RC	Replacement costs
REC	Restoration costs
RP	Revealed preference methods
RUM	Random utility model
SEK	Swedish kronor
SP	Stated preference methods
TCM	Travel cost method
TDB	Tourism and travel database
WTA	Willingness to accept
WTP	Willingness to pay

About this report

This report summarises the results of a survey of empirical economic valuation studies on environmental change in Sweden. Additional components are:

1) A bibliography of valuation studies (Appendix 1 of this report).
2) Summaries of valuation studies (Appendix 2 of this report).
3) A database of valuation studies available for downloading as an Excel file from www.beijer.kva.se/valuebase.htm

The report describes the database and how data were collected for the survey. It also highlights some general findings about the valuation studies.

1 Introduction

The number of empirical studies on the economic value of environmental change has increased rapidly in the last 20 years. Several different methods of valuing environmental change are available – they will be listed later in this report. The reader is referred to Freeman (2003) for a thorough and quite advanced exposition of the methods and their theoretical basis. Less advanced expositions are found in, for example, Brännlund and Kriström (1998), Perman et al. (2003) and Söderqvist et al. (2004). The growing number of valuation studies might reflect an increasingly widespread view that it is important and relevant to consider environmental effects also in economic analyses of human activities. For example, Carson (2004) provides a bibliography of more than 5,000 contingent valuation studies from over 100 countries. There is an increase in the attempts of putting an economic value on environmental change also in Sweden. Slightly more than 10 years ago, Kriström (1992) summarized about a dozen Swedish valuation studies. To the knowledge of the authors, the most recent comprehensive survey of Swedish valuation studies was published four years later (Söderqvist 1996). It summarized about 60 valuation studies.

This report is one result of a project aiming at a thorough update of the 1996 survey. Another result of the project is the compilation of a database including some detailed information about each valuation study. We hope that this project will result in a more convenient access to information in Swedish valuation studies and thus give the following benefits:

- Increasing chances of valuation results to be used in cost-benefit analyses (CBA) and other tools for decision-making.
- Increasing knowledge about methodological improvements in valuation studies.
- Avoiding unnecessary repetitions of valuation studies.
- Assisting the generalization of estimated values to new settings following some benefit transfer procedure. Incidentally, such benefit transfers have to be made with great care, see e.g. Brouwer and Spaninks (1999).
- Facilitating the establishment of networks between people interested in valuation issues.
- Increasing the opportunities to make general conclusions about the economic value of environmental change and to carry out meta-analyses of valuation results.
- Facilitating the integration of Swedish valuation results into international databases such as EVRI (The Environmental Valuation Reference Inventory, see www.evri.ca).

The report is organized as follows. The project, including the data collection procedure and results, is described in section 2. The database is described in some

more detail in section 3. Section 4 contains some statistics about the valuation studies that were surveyed. Some final remarks are found in section 5.

2 The project

The project work was carried out in August-December 2003. In order to collect valuation studies, 106 Swedish organisations were approached by post in the end of August 2003. The organisations included Swedish universities and university colleges, research institutes, authorities and consultancy firms. They were asked to report whether they had conducted any valuation study since 1996, when the latest survey of Swedish valuation studies was made. We also searched for valuation studies in various literature databases and on the Internet, and by getting in touch with various Swedish environmental economists.

The search for valuation studies was limited to studies which have valued some environmental change in Sweden in economic terms. Environmental change is a broad term and might include such things as changes in environmental quality and changes in the provision of environmental/ecosystem goods and services. We have also included valuation studies about health risk changes in cases when such changes were caused by some environmental change, e.g. pollution.

Another limitation in the search for valuation studies concerns the type of data used in the study. Four different categories of valuation studies can be distinguished:

1. Those based on new (primary) data – these studies are referred to as "primary studies" in the following.
2. Benefit transfer studies and other valuation studies based on secondary data, i.e. data collected in earlier primary studies. We use the label "secondary studies" in the following.
3. Those carrying out a meta-analysis. Such "meta studies" are based on a merged data set consisting of primary data from earlier studies.
4. Those summarizing the results of earlier valuation studies – these studies are referred to as "reviews" in the following.

The main purpose of the project was to collect primary studies. However, the search for primary studies also resulted in a by-catch of secondary studies, meta studies and reviews. We believe that we have been quite successful in finding most of the primary studies that have been carried out in Sweden. Of course, some primary studies still remain to be found. In particular, we experienced difficulties in finding studies conducted by consultancy firms and master theses and other undergraduate theses at universities and university colleges. Such types of studies might thus be particularly underrepresented in our survey.

There are three main results of the project:

1) A *bibliography* of all valuation studies. This bibliography is found as Appendix 1 to this report and include primary studies as well as the secondary studies, meta studies and reviews that we came across.

2) The primary studies were summarized, and the *list of summaries* is found as Appendix 2 to this report.
3) All studies included in the bibliography were entered into an Excel document for creating a *database* called ValueBase^{SWE} (Valuation study database for environmental change in Sweden). The database is available for downloading from www.beijer.kva.se/valuebase.htm.

By using the “find” or “sort” commands in Excel, it is easy to search in the database for, for example, studies from a specific year or by a specific author, or for studies where a specific valuation method has been applied. The information found about the studies in the database is further explained below. Finally, it should be noted that we did not assess the quality of the studies before including them in the bibliography, list of summaries and the database. This means that some of the included studies might suffer from methodological or other weaknesses.

3 The database

At the time of writing, the database ValueBase^{SWE} contains information about 170 valuation studies of environmental change in Sweden. As noted in the previous section, primary studies as well as secondary studies, meta studies and reviews are included in the database. However, detailed information about the study was only entered for the primary studies. The information entered for the other studies is restricted to the information in the bibliography in Appendix 1.

3.1. The EVRI database

When developing a method for information to include in ValueBase^{SWE}, the Environmental Valuation Reference Inventory (EVRI), developed by Environment Canada, served as a model. EVRI is a searchable database of empirical environmental valuation studies and the database is accessible through the Internet (www.evri.ca). Valuation studies are entered into a structured capture form in EVRI, with the purpose of facilitating benefit transfer.

There are six main categories of information in EVRI: study reference, study area and population characteristics, environmental focus of the study, study methods, estimated values and abstract (Navrud and Vågnes 2000). Each category consists of a number of fields, where data is entered, and it is required that data are entered into a minimum of 12 specified fields for the entry to be valid. To facilitate a possible future entry of Swedish valuation studies in EVRI, we considered these compulsory fields when constructing the database. In ValueBase^{SWE}, information about the studies is entered into 30 fields, which are described below.

3.2. Data fields in ValueBase^{SWE}

Figure 1 gives a hint about how ValueBase^{SWE} looks when the Excel document is opened. The valuation studies are found as rows in the spreadsheet (Sheet1), and each column represents a type of information about the studies. Sheet2 contains a list of abbreviations used in the database.

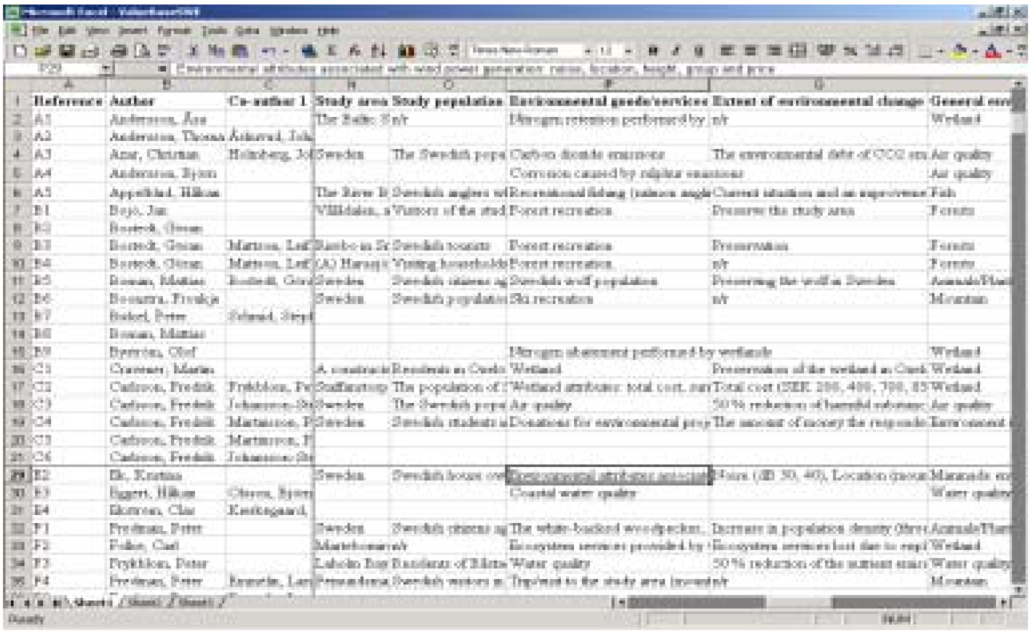


Figure 1. ValueBase^{SWE}

Each study was given a *Reference number* (column A) organized after the first letter of the (first) author’s surname. The publications have been marked with this reference number and are at present found in a special section of the library of the Beijer Institute.

Bibliographic information about each study is provided under the headings *Author* (B), *Co-author* (C-E), *Year* (F), *Title* (G), *Document type* (H) and *Source of study* (I). The names of the author and a maximum of three co-authors are provided. *Year* refers to the year of publication. The studies are categorized into one of the following seven document types:

1. journal
2. report
3. doctoral thesis
4. licentiate thesis
5. thesis (e.g. MSc or BSc thesis)
6. conference paper
7. chapter in book

The studies are classified in the field *Type of study* (J) according to whether they are primary studies, secondary studies, meta studies or reviews. Studies which have made use of both primary and secondary data are classified as primary studies.

In the next field, *Relation to other studies* (K), the reference numbers of other related studies are reported. An example of information in this field is reference numbers of follow up studies or reviews where information about the entry is also found. If the result of a valuation study has been published more than once, the

entry is made for the reference that is most recently published. In this case, information about previous studies is provided in the field *Relation to other studies*.

The information described above (columns A-K) is provided for all valuation studies. In the remaining fields only information about primary studies has been entered. First, the *Valuation method* (L) used is mentioned. The following abbreviations have been used:

1. Revealed preferences (RP) methods:
   1.1. The production function method (PF)
   1.2. The travel cost method (TCM)
   1.3. The hedonic price method (HP)
   1.4. The defensive expenditure method (DE)
2. Stated preferences (SP) methods:
   2.1. The contingent valuation method (CVM)
   2.2. Choice experiments (CE)
   2.3. Choice modelling (CM)
3. Other valuation methods (less rooted in welfare economics theory):
   3.1. The human capital method (HCM)
   3.2. Costs of realizing political decisions (political WTP)
   3.3 Other cost based approaches: replacement costs (RC) and restoration costs (REC)[2].

Further information about the valuation method is provided in the field *Specification of the valuation method* (M). The type of survey method and the type of questions are examples of information captured by this field. In the field *Study area* (N), information is provided about the specific geographic area/location or part of Sweden where the study site is located. The next field contains information about the *Study population* (O).

Four fields are used to describe the environmental change that is valued in the study. The field *Environmental goods/services* (P) describes the good, service or quality being valued according to the valuation study. In the following field, *Extent of environmental change* (Q), information is entered about the magnitude of the environmental change valued in the study. The environmental goods/services are subsequently categorized in two different ways. In the field *General environmental asset* (R), the valued goods and services are classified according to the ecosystem/environmental resource that produces them. For example, “forest” is entered in this field for a valuation study estimating the economic value of forest recreation. As another example, “wetland” is entered if a wetland’s nitrogen abatement capacity is valued.

[2] See Sundberg (2004) on conditions for the replacement cost method to result in valid estimates of economic values.

In the last field used to categorize the environmental goods/services, the studies are sorted after the Swedish *Environmental quality objectives* (S). In 1999, the Swedish Parliament adopted 15 environmental quality objectives. These objectives describe goals for a sustainable development for different parts of the environment in Sweden. The valuation studies have been classified according to their relation to a specific environmental quality objective. Note that more than one general environmental asset and more than one environmental quality objective might be entered for a single valuation study if the study in question is broad enough to concern more than one asset or objective.

The information about the environmental goods and services is followed by three fields about the sample: *Sample size* (T), *Sampling* (U) and *Response rate* (V). *Sample size* is defined as the original sample size of the study, before any adjustments have been made. *Sampling* describes how the sample is chosen from the target population. *Response rate* is defined as the number of responses divided by the net sample size.

The following field, *Year of data* (W), refers to the year in which data were collected. If the value reported in the study was discounted to reflect another year, the latter year is instead entered in the *Year of data* field. In the next field information about the *Payment vehicle* (X) is provided. This is only applicable to studies which have applied some stated preferences method. In the field *Economic measures* (Y) the type of economic measure that was estimated in the study is entered, such as willingness to pay (WTP), willingness to accept compensation (WTA), consumer surplus (CS), marginal consumer surplus (MCS), equivalent variation (EV), compensating variation (CV) and producer surplus (PS). In this field it is also reported if statistics related to the estimated value, such as mean, median and confidence interval, are provided in the study.

The next field reports the *Estimated values* (Z). The values are expressed in SEK per person if nothing else is stated. Note that the values are reported as they are stated in the valuation study. They have thus not been converted to any base year. As a result the values are not comparable between studies.

In the field *Valuation function* (AA) it is reported whether a valuation function is presented in the study. Information about the dependent variable and the explanatory variables is entered in the field *Specification of the valuation function* (AB). If it is clear from the study that its results have been used in a cost-benefit analysis or for policy decisions this is reported by a “yes” in the field *Used in CBA/policy* (AC). The last field is used for any additional *Remarks* (AD).

Finally, note that time restrictions implied that a few studies remain to be summarized. They are marked with an “*” in the field *Relation to other studies* (K). Further, a question mark is used to indicate that information for a specific field is not provided by the valuation study. Note that only information available in the studies is entered into the database, so we have not tried to include any own interpretations

when information was missing. In addition, the notations used in the studies have been used as far as possible. It should also be mentioned that every field is not relevant to all valuation studies due to, for example, the specific valuation method applied in the study. If a field is not relevant, this is indicated by “n/r”.

4 Some statistics

The database contains information about more than 100 primary valuation studies. In figure 2 the allocation of studies between primary, secondary, meta and review studies is shown.

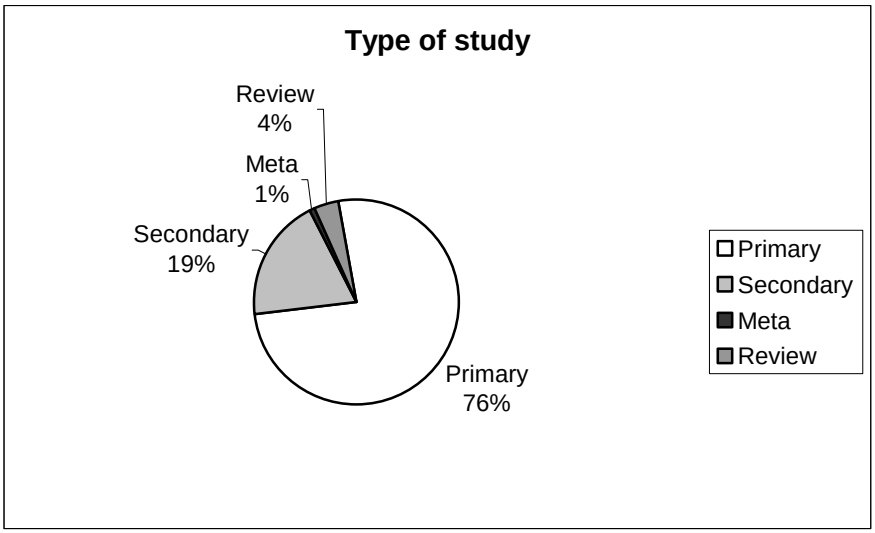


Figure 2. Type of study

Figure 3 shows what main valuation approaches have been used in the primary studies, cf. the list in section 3.2. Almost 70 per cent of the studies have applied the contingent valuation method or some other SP method. About 20 per cent of the studies have used some kind of RP method and about 10 per cent have used some other valuation method.

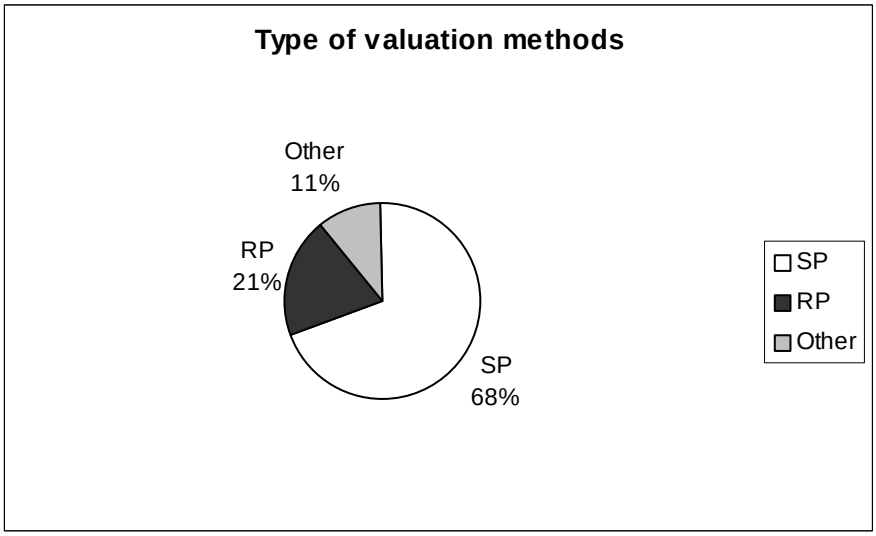


Figure 3. Types of valuation methods

What is the most popular SP method? Figure 4 shows that it is the contingent valuation method, which account for 82 per cent of the SP studies. The methods called "other SP" in Figure 4 are choice experiments or similar methods based on respondents' choices between different policy outcomes.

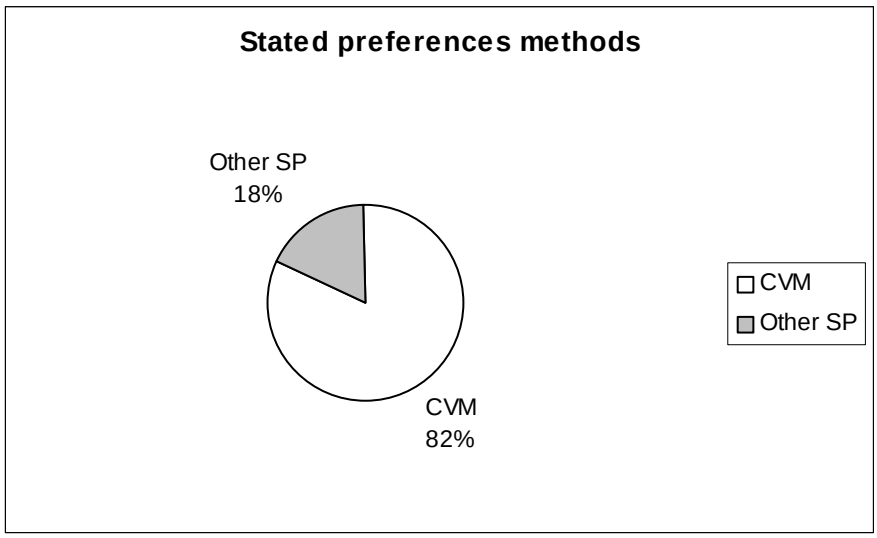


Figure 4. Stated preferences methods

The earliest contingent valuation study included in the database is Jan Bojö's valuation of the nature in Vålådalen in Jämtland County (Bojö 1985). The first SP study in the database that applied another method than CVM was published in 1993 (Widlert et al. 1993). Figure 5 suggests that other SP methods than CVM, primarily choice experiments, have become more popular in recent years.

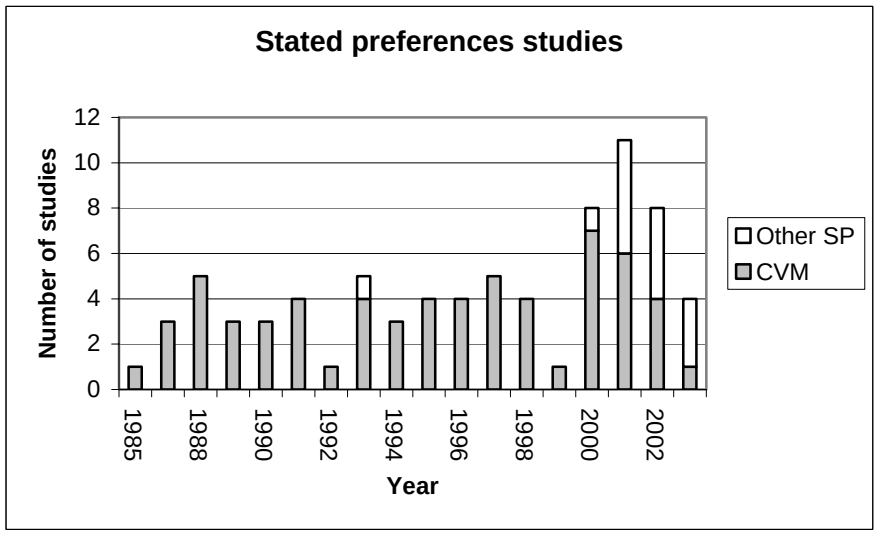


Figure 5. The use of stated preferences methods over time

The most used RP method is the travel cost method followed by the hedonic price method, see figure 6 below. The travel cost studies included in the database have mainly focused on the value of recreational benefits of different areas. The first application of the travel cost method was published in 1982 (Hjalte 1982). The aim of this study was to establish a value of water quality and recreation at a lake in southeastern Sweden. The earliest hedonic price study included in the database is Thomas Hammar's valuation of traffic noise in Täby north of Stockholm (Hammar 1974).

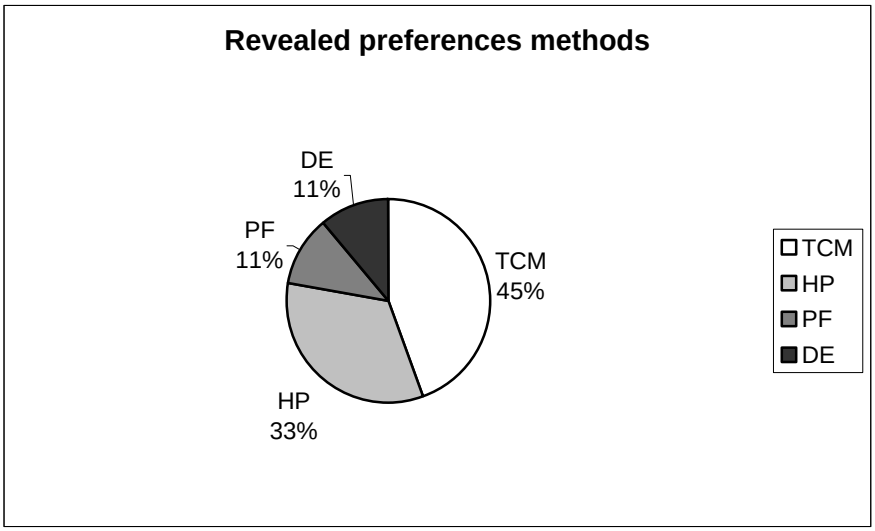


Figure 6. Revealed preferences methods

The primary valuation studies have been grouped according to the environmental good or service that is valued. Table 1 suggests that the two largest categories are *manmade environment* and *water quality*. The majority of studies in the category *manmade environment* are encroachment cost studies of different types of infrastructure investments, where for example traffic noise or a changed view is valued. The second largest group is valuation studies of *water quality*. The group contains studies of both fresh water and marine water quality. However, this category does not include valuation studies of recreational fisheries; these are found in the category *fish*. *Forests* and *air quality* are two other categories which have been subject to valuation to a quite high degree. In addition the following categories are used: *agricultural land*, *wetlands*, *mountains*, *animals/plants* and *environment in general*. It is important to note that several environmental goods and services might have been valued in a single study. As a consequence, the number of valuation studies in Table 1 cannot be added to get the total number of studies included in our survey.

Table1. Valuation studies related to general environmental assets

General environmental asset	Number of valuation studies
Manmade environment	32
Water quality	20
Forests	16
Air quality	16
Fish	12
Agricultural land	7
Mountains	6
Wetlands	6
Animals/Plants	4
Environment in general	3

We also examined how the primary valuation studies are related to the Swedish environmental quality objectives. Table 2 shows the number of studies that was identified for each environmental quality objective. Note that several studies are related to two or more environmental quality objectives. The largest group of valuation studies was related to the environmental quality objective *a good built environment*. Other large groups are: *flourishing lakes and streams*, *sustainable forests* and *clean air*. Only one valuation study was identified for each of the objectives *reduced climate change* and *a safe radiation environment* and none of the studies in the survey was found to be related to the objective *a protective ozone layer*.

Table 2. Valuation studies related to the Swedish environmental quality objectives

Environmental quality objectives	Number of valuation studies
A good built environment	33
Flourishing lakes and streams	20
Sustainable forests	19
Clean air	15
Zero eutrophication	9
A balanced marine environment, flourishing coastal zones and archipelagos	8
A varied agricultural landscape	7
Thriving wetlands	6
A magnificent mountain landscape	6
A non toxic environment	3
Natural acidification only	3
Good-quality groundwater	2
A safe radiation environment	1
Reduced climate change	1
A protective ozone layer	0

Another interesting question is whether the valuation studies have been used in cost-benefit analyses or contributed to guiding decision-making in some other way.

However, this might be difficult to find out from the information provided in the database. When the field *Used in CBA/policy* is examined one finds that only five studies seem to be a part of a cost-benefit analysis or have been used in decision-making. This is not a surprising finding, since the use of CBA is at present rather limited in Sweden (Frykblom and Helgeson 2002). From the information in the database it would still be unfair to make the conclusion that very few valuation studies are used in CBA or policy, since it is only based upon the information actually given in the valuation studies. The values derived in the primary studies could at a later stage have been used as input in a CBA or provided the basis for designing a policy.

A somewhat related issue is whether the valuation studies were mainly carried out in the academic world or in the world of actual policy-making. The former world seems to be the most active arena for valuation studies in Sweden. Figure 7 presents the number of studies in each category of document type. The most clear-cut academic types of documents are scientific journals, doctoral theses and licentiate theses. These categories account for 34 per cent of all documents. In addition, a majority of the documents in the report category is working papers from universities or academic research institutes.

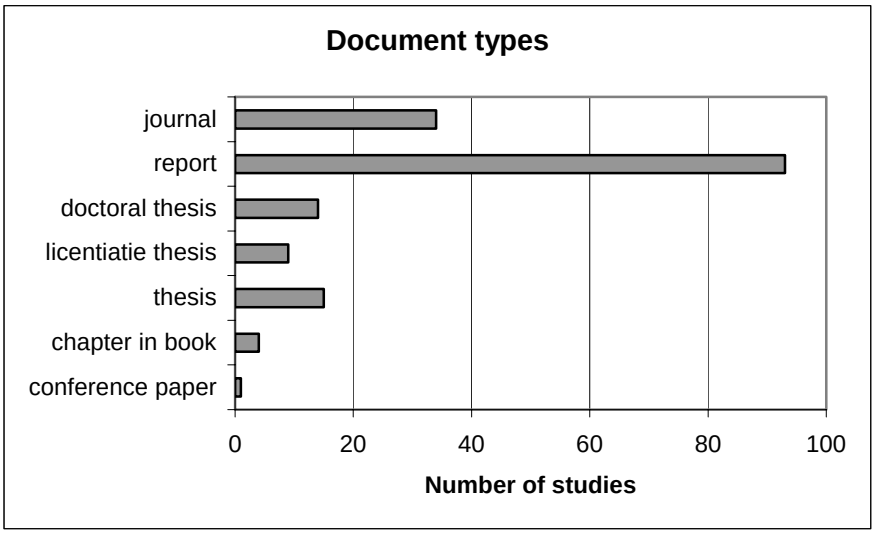


Figure 7. Document types

5 Final remarks

There are at least three possible future extensions of this project if funds and time are available. First, we hope that ValueBase^{SWE} can be updated not too far in the future. Second, ValueBase^{SWE} can be developed from a simple Excel document into a more advanced, web-based database. Third, the database might be integrated into international databases such as EVRI.

While our aim was to make the bibliography, summaries and database as complete as possible for primary studies, there are of course studies that we were not able to find. We therefore end this report by asking the reader to get in touch with us if he or she notices that any valuation study is missing. Information about valuation studies published after our project was finalized is also most welcome. We would also be grateful to be informed about any errors that might exist in the bibliography, summaries and the database. The possible presence of errors and the fact that we did not assess the quality of the studies imply that the original valuation study document should always be consulted by anyone who are going to use the data in the summaries or in the database.

Finally, we would like to thank Ulrika Lindstedt, Oskar Larsson and participants at a seminar about ValueBase^{SWE} at the Swedish Environmental Protection Agency for helpful comments and support, Anna Sjöström for making the webpage, and the Swedish Environmental Protection Agency for funding this project.

References

Bojö, Jan (1985), ”Kostnadsnyttoanalys av fjällnära skogar: Fallet Vålådalen”. Research Report, The Economic Research Institute, Stockholm School of Economics.

Brännlund, Runar and Bengt Kriström (1998), *Miljöekonomi*. Studentlitteratur, Lund.

Brouwer, R. and F. A. Spaninks (1999), “The Validity of Environmental Benefit Transfer: Further Empirical Testing”, *Environmental and Resource Economic* 14, 95-117.

Carson, Richard T. (2004), *Contingent Valuation – A Comprehensive Bibliography and History*. Edward Elgar Publishing, Cheltenham, UK.

Freeman III, A. Myrick (2003), *The Measurement of Environmental and Resource Values – Theory and Methods*, 2nd Edition. Resources for the Future, Washington, DC.

Frykblom, Peter and Alexandra Helgeson (2002), ”Cost-benefitanalys inom miljöområdet: en kartläggning”. Rapport 5198, Swedish Environmental Protection Agency, Stockholm.

Hammar, Thomas (1974), “Trafikimmissioners inverkan på villapriser”. Mimeo, The Swedish National Road Administration, The County of Stockholm, (Vägförvaltningen), Solna.

Hjalte, Krister, Karl Lidgren, Anna-Lisa Thelander and Curt Wells (1982), ”Ekonomiska konsekvenser av vattenkvalitetsförändringar i sjöar”. Report TEM, Lund University.

Kriström, Bengt (1992), ”Hur mycket vill svenska folket betala för en bättre miljö?” *Ekonomisk Debatt* 3, 209-219.

Navrud, Ståle and Mette Vågnes (2000), "Assessment of Environmental Valuation Reference Inventory (EVRI) and the Expansion of Its Coverage to the EU". Report to the European Commission, DG XI.

Perman, Roger, Yue Ma, James McGilvray and Michael Common (2003), *Natural Resource and Environmental Economics, Third Edition*. Pearson Education Ltd., Harlow, Essex, UK.

Sundberg, Sara (2004), "Replacement costs as economic values of environmental change: A review and an application to Swedish Sea trout habitats". Beijer Discussion Paper Series No. 184, Beijer International Institute of Ecological Economics, The Royal Swedish Academy of Science, Stockholm.

Söderqvist, Tore (1996), "Ekonomisk värdering av miljön: Metoder och svenska erfarenheter", p. 5-73 in *Expertrapporter från Skatteväxlingskommittén*, SOU 1996:117. Ministry of Finance, Stockholm.

Söderqvist, Tore, Monica Hammer and Ing-Marie Gren (2004). *Samverkan för människa och natur – en introduktion till ekologisk ekonomi*. Studentlitteratur, Lund.

Widlert, Staffan, Gunnar Lind, Esbjörn Lindqvist, Johanna Lindqvist and Ulrika Lindstedt (1993), "Värdering av miljöfaktorer". Transek, Solna.

Appendix 1

A bibliography of valuation studies on environmental change in Sweden *

Andersson, Björn (1994), ”Korrosionskadekostnader orsakad av SO_2-emissioner”. Appendix to The National Institute of Economic Research and Statistics Sweden, *Svenska miljöräkenskaper: En lägesrapport*. Stockholm. Reference number: A4

Andersson, Thomas and Johan Åshuvud (1984), ”Kolets miljöeffekter – ett ekonomiskt problem”. *Ekonomisk Debatt*, 12, no 2, 107-115. Reference number: A2

Andersson, Åsa (1994), “Estimating the Potential Ecological Retention/Elimination Service Performed by Natural Wetlands in the Baltic Sea Drainage Basin”. Master thesis 1994:9, Department of Systems Ecology, Stockholm University. Reference number: A1

Appelblad, Håkan (2001), “The Spawning Salmon as a Resource by Recreational Use. The case of the wild Baltic salmon and conditions for angling in north Swedish rivers”. Doctoral thesis, GERUM 2001:3, Department of Social and Economic Geography, Umeå University. Reference number: A5

Azar, Christian and Johan Holmberg (1995), “Defining the generational environmental debt”. *Ecological Economics*, 14, 7-19. Reference number: A3

Bickel, Peter, Stephan Schmid and Rainer Friedrich (2002), “Estimation of Environmental Costs of the Traffic Sector in Sweden”. Institute of Energy Economics and the Rational Use of Energy, Stuttgart. Reference number: B7

Bojö, Jan (1985). "Kostnadsnyttoanalys av fjällnära skogar: Fallet Vålådalen". Research Report, The Economic Research Institute, Stockholm School of Economics. Reference number: B1

Boman, Mattias (1997), *Forest Environmental Economics – General framework, contingent valuation methodology, and welfare analysis of threatened species*. Doctoral thesis, Silvestria 45, Department of Forest Economics, Swedish University of Agricultural Sciences, Umeå. Reference number: B8

Boman, Mattias and Göran Bostedt (1997), “Valuing the wolf in Sweden: Are benefits contingent upon the supply”, In Bostedt, Göran, *Public goods in Swedish forests. Essays on nonmarket valuation and environmental policy*. Doctoral thesis, Silvestria 34, Department of Forest Economics, Swedish University of Agricultural Sciences, Umeå. Reference number: B5

* The reference numbers refer to the reference numbers in the database.

Bostedt, Göran (1995), “Benefits of Amenities in the Forest Environment – Four Papers Based on Contingent Valuation”. Report 110, Department of Forest Economics, Swedish University of Agricultural Sciences, Umeå. Reference number: B2

Boonstra, Froukje (1993), “Valuation of ski recreation in Sweden – a travel cost analysis”. Umeå Economic Studies, No 316, University of Umeå. Reference number: B6

Bostedt, Göran and Leif Mattsson (1991), ”Skogens betydelse för turismen: En samhällsekonomisk pilotstudie”. Arbetsrapport 141, Department of Forest Economics, Swedish University of Agricultural Sciences, Umeå. Reference number: B3

Bostedt, Göran and Leif Mattsson (1995), "The Value of Forests for Tourism in Sweden". *Annals of Tourism Research*, 22, 671-680. Reference number: B4

Byström, Olof (1998), “The replacement value of wetlands in Sweden”, In Byström, Olof, *Cost-Effective Reductions of Nonpoint Source Pollution: Five Essays on Wetlands, Policy, and Modeling*. Agraria 118, Swedish University of Agricultural Sciences, Department of Economics, Uppsala. Reference number: B9

Carlsson, Fredrik and Olof Johansson-Stenman (2000), “Willingness to pay for improved air quality in Sweden”. *Applied Economics*, 32, 661-669. Reference number: C3

Carlsson, Fredrik och Olof Johansson-Stenman (2003), “Costs and Benefits of Electric Vehicles”. *Journal of Transport Economics and Policy*, 37, 1-28. Reference number: C6

Carlsson, Fredrik and Peter Martinsson, (2001), “Do Hypothetical and Actual Willingness to Pay Differ in Choice Experiments? - Application to the Valuation of the Environment”. *Journal of Environmental Economics and Management*, Vol. 41, pages 179-192. Reference number: C4

Carlsson, Fredrik and Peter Martinsson (2001), Willingness to pay for reduction in air pollution: A multilevel analysis. *Environmental Economics and Policy Studies*, 4, 17-27. Reference number: C5

Carlsson, Fredrik, Peter Frykblom and Carolina Liljenstolpe (2001), “Valuing wetland attributes – an application of Choice Experiment”. Working Paper Series 2001:3, Department of Economics, Swedish University of Agricultural Sciences (SLU), Uppsala. (Forthcoming Ecological Economics). Reference number: C2

Cravener, Martin (1995), ”Samhällsekonomisk värdering av den anlagda våtmarken i Oxelösund. En tillämpning av contingent valuation-metoden”. Master thesis, Department of Economics, Stockholm University. Reference number: C1

Dalin, Per-Eric (2000), ”Småviltsjakten på statens mark ovan odlingsgränsen - en samhällsekonomisk analys”. Arbetsrapport 296, Department of Forest, Swedish University of Agricultural Sciences (SLU), Umeå. Reference number: D5

Drake, Lars (1987), ”Värdet av bevarat jordbrukslandskap. Resultat av intervjuundersökningar”. Report 289, Department of Economics and Statistics, Swedish University of Agricultural Sciences, Uppsala. Reference number: D1

Drake, Lars (1992), “The non-market value of the Swedish agricultural landscape”. *European Review of Agricultural Economics*, 19, 351-364. Reference number: D6

Drake, Lars (1994), “Relations among environmental effects and their implications for efficiency of policy instruments”. Report 74, Department of Economics, Swedish University of Agricultural Sciences, Uppsala. Reference number: D2

Drake, Lars (1994), ”Värdering av miljövariabler som påverkas av jordbruksproduktion”, p. 233-241 In *Förstärkta miljöinsatser i jordbruket*, SOU 1994:82. Reference number: D3

Drake, Lars, Kal-Ivar Kumm and Mari Andersson (1991), ”Har jordbruket i Rottnadalen någon framtid? En analys av landskapsvärden och företagsekonomiska kostnader”. Småskriftserien no 48, Department of Economics and Statistics, Swedish University of Agricultural Sciences, Uppsala. Reference number: D4

Eggert, Håkan and Björn Olsson (2003), “Heterogeneous preferences for marine amenities: A Choice experiment applied to water quality”. Paper presented at the SUCOZOMA Conference Rights and Duties in the Coastal Zone. Stockholm, June 2003. Reference number: E3

Ek, Kristina (2002), “Valuing the Environmental Impacts of Wind Power – A Choice Experiment Approach”. Licentiate thesis, 2002:40, Luleå University of Technology. Reference number: E2

Ekström, Clas, Gunilla Kierkegaard and Truls Borgström (1999), ”Monetära värderingar av koldioxidutsläpp – jämförelser mellan biobränslen och fossila bränslen”. SLF Report 45, Swedish Farmers’ Foundation for Agricultural Research (Stiftelsen Lantbruksforskning). Reference number: E4

Eliasson, Peter (1994), ”Miljöjusterade nationalräkenskaper för den svenska skogen åren 1987 och 1991”. Appendix to The National Institute of Economic Research and Statistics Sweden, *Svenska miljöräkenskaper: En lägesrapport*. Stockholm. Reference number: E1

Fahlgren, Louise and Helena Knutsson (2001), ”En sluss till värdering av Göta Kanal – en studie av fastighetspriser”, Master thesis in economics, Forskning från Linköpings universitet; 8, Linköping University Electronic Press. (www.ep.liu.se/ea/gotakanal/2001/008/). Reference number: F7

Folke, Carl (1991), “The Societal Value of Wetland Life-Support”, p. 141-171 In Carl Folke and Tomas Kåberger (eds.), *Linking the Natural Environment and the Economy: Essays form the Eco-Eco Group*. Kluwer Academic Publishers, Dordrecht. Reference number: F2

Fredman, Peter (1995), “Endangered Species: Benefit Estimation and Policy Implications”. Report 109, Department of Forest Economics, Swedish University of Agricultural Sciences, Umeå. Reference number: F1

Fredman, Peter (2000), *Environmental valuation and policy: Applications in the management of endangered species, recreation and tourism*. Doctoral thesis, Silvestria 136, Department of Forest Economics, Swedish University of Agricultural Sciences (SLU), Umeå. Reference number: F6

Fredman, Peter and Lars Emmelin (1999) “Values of Mountain Tourism. Economic Benefits Across Visitor Segments in Femundsmarka, Rogen and Långfjället”. Working Paper 1999:26, The European Tourism Research Institute, ETOUR, Östersund. Reference number: F5

Fredman, Peter and Lars Emmerlin (2001), “Wilderness purism, willingness to pay and management preferences: a study of Swedish mountain tourists”. *Tourism Economics*, 7, 5-20. Reference number: F4

Frykblom, Peter (1998), “Halved Emissions of Nutrients, What are the Benefits? - A Contingent Valuation Survey Applied to Laholm Bay”, in *Questions in the Contingent Valuation Method - Five Essays*, doctoral thesis, Agraria 100, Department of Economics, Swedish University of Agricultural Sciences (SLU), Uppsala. Reference number: F3

Gren, Ing-Marie (1992), “Benefits from Restoring Wetlands for Nitrogen Abatement: A Case Study of Gotland”. Beijer Discussion Papers Series No. 14, The Beijer International Institute of Ecological Economics, The Royal Swedish Academy of Sciences, Stockholm. Reference number: G1

Gren, Ing-Marie (1993), “Alternative Nitrogen Reduction Policies in the Mälar Region, Sweden”. *Ecological Economics*, 7, 159-172. Reference number: G2

Gren, Ing-Marie (1995), “Costs and Benefits of Restoring Wetlands: Two Swedish Case Studies”. *Ecological Engineering*, 4, 153-162. Reference number: G3

Gren, Ing-Marie and Tore Söderqvist (1996), ”Våtmarker – en underskattad ekonomisk resurs?” *Ekonomisk debatt*, 24, no 1, 7-18. Reference number: G4

Gren, Ing-Marie, Tore Söderqvist, Fredrik Wulff, Sindre Langaas, Mikael Sandström and Carl Folke (1996), “Reduced Nutrient Loads to the Baltic Sea: Ecological Consequences, Costs and Benefits”. Beijer Discussion Paper Series No. 83, The Beijer International Institute of Ecological Economics, The Royal Swedish Academy of Sciences, Stockholm. Reference number: G5

Groth, Charlotta (1996), “Biltrafikens miljökostnader – en litteraturstudie”, p. 75-166, In *Expertrapporter från Skatteväxlingskommittén*, SOU 1996:117, Ministry of Finance, Stockholm. Reference number: G13

Grudemo, Stefan (1987), "Förbifart Osbyholm (CVM-studie)". Working paper, The Swedish National Road and Transport Research Institute (VTI), Linköping. Reference number: G12

Grudemo, Stefan (1988), "CVM-studie av intrång i rekreationsområde – fallstudie Klockartorpsleden i Västerås". VTI Notat T29, The Swedish National Road and Transport Research Institute (VTI), Linköping. Reference number: G6

Grudemo, Stefan (1988), "CVM-studie av intrång i rekreations- och naturområde – fallstudie Säterivägen i Mölnlycke". VTI Notat T47, The Swedish National Road and Transport Research Institute (VTI), Linköping. Reference number: G7

Grudemo, Stefan (1994), "Nya vägars intrångskostnader. En sammanställning av resultat av CVM-undersökningar och ”för eller emot”-studier". VTI – meddelande 744/1994, The Swedish National Road and Transport Research Institute (VTI), Linköping. Reference number: G8

Grudemo, Stefan (1999), ”E6 genom Ljungskile – ett omstritt motorvägsbygge. Beskrivning av beslutsprocessen och invånarnas inställning och värdering av effekterna på närmiljön”. VTI meddelande nr 843, The Swedish National Road and Transport Research Institute (VTI), Linköping. Reference number: G9

Grudemo, Stefan (2000), ”CVM-studie av minskad trafik på Trelleborgsvägen i Malmö”. VTI notat nr 31 - 2000, The Swedish National Road and Transport Research Institute (VTI), Linköping. Reference number: G10

Grudemo, Stefan, Pernilla Ivehammar and Jessica Sandström (2002), ”Beräkningsmodell för infrastrukturinvesteringars intrångskostnader”. VTI meddelande nr 939, The Swedish National Road and Transport Research Institute (VTI), Linköping. Reference number: G11 (a, b, c)

Hahn, Gunnela (1996), ”Samhällsekonomisk värdering av kväveoxidrelaterade hälsoeffekter”. Appendix to *Sveriges kostnader för kväveutsläpp, en delrapport av konjunkturinstitutets miljöräkenskapsarbete*. Stockholm. Reference number: H15

Hammar, Thomas (1974), “Trafikimmissioners inverkan på villapriser”. Mimeo, The Swedish National Road Administration, The County of Stockholm, (Vägförvaltningen), Solna. Reference number: H1

Hanemann, W. Michael, Per-Olov Johansson, Bengt Kriström and Leif Mattsson (1992), “Natural Resources Damages from Chernobyl”. *Environmental and Resource Economics*, 2, 523-525. Reference number: H5

Hansson, Lars (1993), ”Vägtrafiken och det trafikpolitiska ansvaret”. Report, Department of Industrial Environmental Economics, Lund University. Reference number: H2

Hansson, Lars (1994), ”Värdering av trafikbuller”. Report. The International Institute for Industrial Environmental Economics, Lund University. Reference number: H3

Hasund, Knut Per (1997),”Documentation of Three Contingent Valuation Surveys on Preservation of Landscape Elements of Agricultural Land”. Småskriftserien no 107, Swedish University of Agricultural Sciences (SLU), Department of Economics, Uppsala. Reference number: H9

Hasund, Knut Per, Lennart Hedvåg and Håkan Pleijel (1990), ”Ekonomiska konsekvenser av det marknära ozonets påverkan på jordbruksgrödor”. Report 3862, The Swedish Environmental Protection Agency, Solna. Reference number: H4

Heiter, Carsten (2000), “Using contingent valuation to measure preferences for the environment. An application to the National City Park Ulriksdal – Haga – Brunnsviken – Djurgården in Stockholm”. Master thesis, Department of Infrastructure and planning, Royal Institute of Technology, Stockholm. Reference number: H7

Heldt, Tobias (2000), Turskidåkarens värdering av externaliteter från skoter. CTEK Working paper 2000:22, Dalarna University and National Institute of Road and Transport Research (VTI), Borlänge. Reference number: H11

Hjalte, Krister (1977) Sjörestaureringens ekonomi. Thesis, Lund Economic Studies. Reference number: H12

Hjalte, Krister, Karl Lidgren, Anna-Lisa Thelander and Curt Wells (1982), ”Ekonomiska konsekvenser av vattenkvalitetsförändringar i sjöar”. Report TEM, Lund University. Reference number: H13

Holgén, P., L. Mattsson and C.-Z. Li (2000), "Recreation values of boreal forest stand types and landscapes resulting from different silvicultual systems: An economic analysis". *Journal of Environmental Management*, 60, 173-180. Reference number: H16

Hougner, Cajsa (2003), Samhällsekonomisk värdering av ekosystemtjänsten nötskrikans fröspridning i Stockholms nationalstadspark. Report, Centre for Research on Natural Resources and the Environment (CNM), Stockholm University. Reference number: H10

Hultkrantz, Lars (1991), "Guld och gröna skogar – Miljömodifierade nationalräkenskaper för inkomster från skogstillgångarna", In *Räkna med miljön! Förslag till natur- och miljöräkenskaper,* SOU 1991:38. Ministry of Finance, Stockholm. Reference number: H14

Hökby, Stina and Tore Söderqvist (2003), "Elasticities of demand and willingness to pay for environmental services in Sweden". *Environmental and Resource Economics*, 26, 361-383. Reference number: H8

Hörnsten, Lisa and Peter Fredman (2000), "On the distance to recreational forests in Sweden". *Landscape and Urban Planning*, 51, 1-10. Reference number: H6

Idar Angelov, Elisabet (2003), "The Studded Tire – a Fair Bargain? A Cost Benefit Assessment". Master Thesis in economics, Department of Economics, Swedish University of Agricultural Sciences (SLU), Uppsala. Reference number: I7

Inregia AB, Institutet för regional analys (1993), "Bromma flygfält: Vad tycker brommaborna och andra stockholmare?" Report, Inregia AB, Stockholm. Reference number: I1

Israelsson, Torun (2001), "Valuing Natural Heritage – An Empirical Application of a Choice Experiment", in Infrastructure Investments and Environmental Preservation – An economic foundation for public decisions. Report 122, Department of Forest Economics, Swedish University of Agricultural Sciences (SLU), Umeå. Reference number: I5

Israelsson, Torun and Bengt Kriström (2001), "If I Had 10 billons to Spend: An Emperical Study of Swedes' Preferences over Budget Allocation", in Infrastructure Investments and Environmental Preservation – An economic foundation for public decisions. Report 122, Department of Forest Economics, Swedish University of Agricultural Sciences (SLU), Umeå. Reference number: I6

Ivehammar, Pernilla (1996), "Värdering av biltunnel framför resecentrum i Linköping med binär CVM". VTI notat 18, The Swedish National Road and Transport Research Institute (VTI), Linköping. Reference number: I2

Ivehammar, Pernilla (1998) ”Problem vid värdering av miljöförändringar av investeringar i transportinfrastruktur. Fallstudie om Centralbron i Stockholm i tunnel utförd med binär CVM”. VTI notat 16-1998, The Swedish National Road and Transport Research Institute (VTI), Linköping. Reference number: I4

Ivehammar, Pernilla (2001), ”Värdering av miljöförändring i tid respektive pengar – exemplet Ugglumsleden i Partille”. VTI notat 25-2001, The Swedish National Road and Transport Research Institute (VTI), Linköping. Reference number: I3

Jansson, Jan Owen and Jan-Eric Nilsson (1989), ”Spelar samhällsekonomiska kalkyler någon verklig roll i vägväsendet?” *Ekonomisk debatt*, 17, no 2, 85-95. Reference number: J6

Jernelöv, Arne (1992), ”Miljöskulden. En rapport om hur miljöskulden utvecklas om vi ingenting gör”. SOU 1992:58. Ministry of the Environment (Miljö- och naturresursdepartementet), Stockholm. Reference number: J1

Jernelöv, Arne (1993), ”Mer om miljöskulden”. Report 1993:3, Miljövårdsberedningen, Ministry of the Environment (Miljö- och naturresursdepartementet), Stockholm. Reference number: J2

Jernelöv, Arne (1994), ”Miljöskuld och miljökapital: Uppsala kommun”. Report 1994:3, Miljövårdsberedningen, Ministry of the Environment (Miljö- och naturresursdepartementet), Stockholm. Reference number: J3

Jernelöv, Arne and Per Kågeson (1992), ”Biologisk mångfald i Sverige: Hur klarar vi uppdraget?” Report 1992:3, Miljövårdsberedningens, Ministry of the Environment (Miljö- och naturresursdepartementet), Stockholm. Reference number: J4

Johansson, Olof (1995), “External Costs of Road Transport in Sweden”, In David Pearce (ed.), *Blueprint 5: The True Costs of Road Transport*. Earthscan, London. Reference number: J9

Johansson, Per-Olov (1989), “Valuing public goods in a risky world: An experiment”. p.37-48 In Henk Folmer och Ekko van Ierland (eds.), *Valuation Methods and Policy Making in Environmental Economics*. Studies in Environmental Science 36, Elsevier Science Publishers, Amsterdam. Reference number: J8

Johansson, Per-Olov (1990), “Willingness to pay measures and expectations: an experiment”. *Applied Economics*, 22, 313-329. Reference number: J13

Johansson, Per-Olov and Bengt Krisrtöm (1988), “Measuring values for improved air quality from discrete response data: two experiments”. *Journal of Agricultural Economics*, 39, 439-455. Reference number: J5

Johansson, Per-Olov, Bengt Kriström and Leif Mattsson (1988), “How is the Willingness to Pay for Moose Hunting Affected by the Stock of Moose? An Empirical Study of Moose-hunters in the County of Västerbotten”. *Journal of Environmental Management*, 26, 163-171. Reference number: J11

Johansson, Per-Olov, Bengt Kriström and Hans Nyquist (1993), “Valuing a public good using the Contingent Valuation Method: Bid Vectors, Spikes and Risk”. Mimeo, Department of Economics, Stockholm School of Economics. Reference number: J12

Johansson, Per-Olov and Stojan Zavisic (1989), ”Svenska folkets miljöbudget”. *Ekonomisk Debatt*, 17, 6, 472-474. Reference number: J7

Jämttjärn, Joachim (1996), ”Den svenska skogens rekreationsvärde”. Appendix to *Sveriges kostnader för kväveutsläpp, en delrapport av konjunkturinstitutets miljöräkenskapsarbete*. Department of Economics, Swedish University of Agricultural Sciences (SLU), Uppsala. Reference number: J10

Katz, Katarina and Thomas Sterner (1989), ”Värdering av renare luft”. *Ekonomiska Samfundets Tidskrift*, 4, 243-256. Reference number: K1

Katz, Katarina and Thomas Sterner (1990), ”The Value of Clean Air: Consumers’ Willingness to Pay for a Reduction in Gasoline Vapours at Filling Stations”. *Energy Studies Review*, 2, 39-47. Reference number: K2

Kihlman, Tor, Sören Wibe and Siv M. Johansson (1993), “Priset på tystnad: En enkätstudie om människors värdering av bullerdämpande åtgärder”, Appendix 7 to *Handlingsplan mot buller*. SOU 1993:65. Ministry of the Evironment (Miljö- och naturresursdepartementet), Stockholm. Reference number: K9

Konjunkturinstitutet (1998), ”Svenska miljöräkenskaper för kväve och svavel – en utvärdering av FNs miljöräkenskapsuppställning”. Monetary environmental accounts, Report 1998:9, National Institute of Economic Research, Stockholm. Reference number: K7

Konjunkturinstitutet (1998), ”Sveriges kostnader för kväveutsläpp - värderingsstudier”. Monetary environmental accounts, Report 1998:9, National Institute of Economic Research, Stockholm. Reference number: K8

Kriström, Bengt (1990), “Valuing Environmental Benefits Using the Contingent Valuation Method – An Econometric Analysis”. Doctoral thesis, Umeå Economic Studies No 219, Umeå University. Reference number: K3

Kriström, Bengt (1992), “Hur mycket vill svenska folket betala för en bättre miljö?” *Ekonomisk Debatt*, 3, 209-219. Reference number: K10

Kriström, Bengt (1997), “Spike Models in Contingent Valuation”. *American Journal of Agricultural Economics*, 79, 1013-1023. Reference number: K6

Kågesson, Per (1993), “Getting the Prices Right: A European Scheme for Making Transport Pay Its True Costs”. Report 93/6, European Federation for Transport and Environment, Bryssel. Reference number: K4

Kågesson, Per (1993), ”Sätt rätt pris på trafiken: En europeisk analys av trafikens miljökostnader. Svensk nationalrapport”. European Federation for Transport and Environment, and Naturskyddsföreningen (The Swedish Society for Nature Conservation), Stockholm. Reference number: K5

Laitila Thomas and Anton Paulrud (2002), “Combining Conjoint Analysis and Choice Experiments for Valuation of Fishing Site Characteristics”. Arbetsrapport 329, Department of Forest Economics, Swedish University of Agricultural Sciences (SLU), Umeå. Reference number: L8

Landell, Elin and Stefan Smith (1988), ”Miljökostnader av väginvesteringar - en metodstudie”. Master thesis in Economics T7, Linköping University. Reference number: L1 (a,b)

Leksell, Ingemar (1987), ”Ekonomisk värdering av lokala luftföroreningar från flyg-, fartygs- och järnvägstrafik”. Department of Environmental Science, Göteborg University. Reference number: L2

Leksell, Ingemar (1987), ”Samhällsekonomisk värdering av bilavgasutsläpp”. DsK 1987:6, Ministry of infrastructure (Kommunikationsdepartementet), Stockholm. Reference number: L3

Leksell, Ingemar and Lars Löfgren (1995), ”Värdering av lokala luftföroreningseffekter - hur värdera bilavgasernas hälsoeffekter i tätorter?” Report 1995:5, The Swedish Transport & Communications Research Board (KFB), Stockholm. Reference number: L4

Leksell, Ingemar (1999) ”Ekonomisk värdering av luftföroreningar från trafiken”. Volume 1-3. Department of Applied Environmental Science, Göteborg University. A report to SIKA (Swedish Institute for Transport and Communication Analysis). Reference number: L10

Leksell, Ingemar (2000), “Health costs of particle emissions – Economic valuation of increased mortality due to exhaust emissions of fine particles”. Licentiate thesis, Department of Physical Resource Theory, Chalmers University of Technology and Göteborg University. Reference number: L12

Li, Chuan-Zhoung and Peter Fredman (1994), “On Reconciliation of the Discrete Choice and Open-Ended Responses in Contingent Valuation Experiments”, In

Chuan-Zhoung Li (1994), *Welfare Evaluations in Contingent Valuation – An Econometric Analysis*. Doctoral thesis. Umeå Economics Studies No. 341, Umeå University. Reference number: L5

Lind, Gunnar, Johanna Lindqvist and Jonas Eliasson (2002), ”Värdet av boende-, kultur- och naturmiljö – förändringar p.g.a. trafikens inverkan”. Report, Transek, Solna. Reference number: L16

Lindberg, Kreg, Tommy D. Andersson and Benedict G. C. Dellaert (2001), “Tourism Development – Assessing Social Gains and Losses”. *Annals of Tourism Research*, 28, 1010-1030. Reference number: L14

Lindberg, Kreg, Jon Martin Denstadli, Peter Fredman, Tobias Heldt and Tuomas Vuorio (2001), ”Skiers and snowmobilers in södra Jämtlandsfjällen: Are there recreation conflicts?” Working paper 2001:12, The European Tourism Research Institute, ETOUR, Östersund. Reference number: L9

Lindqvist Dillén, Johanna, Jonas Eliasson, Jenny Widell and Isak Jarlebring (2003), ”Värdering av intrångseffekter”. Transek, Solna. Reference number: L15

Lindvall, Jan (2001), ”Betalningsvilja för Göta Kanal”. Forskning från Linköpings universitet; 4. Linköping University Electronic Press. (www.ep.liu.se/ea/gotakanal/2001/004/). Reference number: L6

Lundström, Susanna (1997), ”Bör vi dricka ekologisk mjölk? – en samhällsekonomisk jämförelse mellan konventionell och ekologisk mjölkproduktion”. Rapport 109, Department of Economics, Swedish University of Agricultural Sciences (SLU), Uppsala. Reference number: L11

Löfgren, Tora and Mattias Hjerpe (2001), ”Ekonomisk värdering av Göta Kanal med Contingent Valuation Method”. Master Thesis in Economics. Forskning från Linköpings universitet; 3. Linköping University Electronic Press. (www.ep.liu.se/ea/gotakanal/2001/003/) Reference number: L7

Löwgren, Marianne (2001), ”Emåns nyttjande och hävd – En undersökning av marknadsvärden”. VASTRA report 2, Tema Vatten, Linköping University. Reference number: L13

Magnell, Mats, Fredrik Ljungahl and Thomas Parker (1994), ”Statens miljövårdskostnader”. Department of industrial environmental economics, Lund university. Reference number: M6

Malmberg, Johan (1994), ”Attityder till bekämpningsmedel och betalningsviljan för en minskad användning av dess i det svenska jordbruket”. Master thesis 126, Natural Resource and Environmental Economics, Department of Economics, Swedish University of Agricultural Sciences, Uppsala. Reference number: M1

Mattsson, Leif (1990), “Hunting in Sweden: Extent, Economic Values and Structural Problems”. *Scandinavian Journal of Forest Research*, 5, 563-573. Reference number: M2

Mattsson, Leif and Bengt Kriström (1987), “The Economic Value of the Moose as a Hunting Object”. *Scandinavian Journal of Forest Economics*, 29, 27-37. Reference number: M3

Mattsson, Leif and Chuan-Zhong Li (1993), “The Non-Timber Value of Northern Swedish Forests”. *Scandinavian Journal of Forest Research*, 8, 426-434. Reference number: M4

Mattsson, Leif and Chuan-Zhong Li (1994), “How do Different Forest Management Practices Affect the Non-Timber Value of Forests? An Economic Analysis”. *Journal of Environmental Management*, 41, 79-88. Reference number: M5

Nerhagen, Lena and Håkan Johansson (2003), “Variations in the external cost of transport air pollution – the case of Sweden”. VTI notat 36A- 2003, The Swedish National Road and Transport Research Institute, Linköping. Reference number: N2

Nilsson, Måns and Monica Gullberg (1998), “Externalities of Energy: Swedish Implementation of ExternE Methodology: The contingent valuation study on Klippen”. Stockholm Environment Institute (SEI). Reference number: N1

Olsson, Christina (1993), ”Linbanan i Norsjö - en skogsinriktad turistattraktion. En undersökning av besökarnas betalningsvilja för att uppleva skog och natur”. Master thesis in Economics, Umeå Economic Studies No 325, University of Umeå. Reference number: O1

Paulrud, Anton (2000), ”Ekonomisk analys av sportfiskarnas val av fiskeplats – en pilotstudie gällande för öring- och harrfiske i rinnande vatten”. Arbetsrapport 290, Department of Forest Economics, Swedish University of Agricultural Sciences (SLU), Umeå. Reference number: P2

Paulrud, Anton (2001), ”Sportfisket i Bohuslän – samhällsekonomiska aspekter”. Arbetsrapport 300, Department of Forest Economics, Swedish University of Agricultural Sciences (SLU), Umeå. Reference number: P1

Paulrud, Anton (2003), “Marginal Valuation of Improving The Catch for Sportfishers”. Arbetsrapport 333, Department of Forest Economics, Swedish University of Agricultural Sciences (SLU), Umeå. Reference number: P5

Paulrud, Anton (2003), “Recreational Values of Different Types of Sport-Fishing in Western Sweden”. Arbetsrapport 334, Department of Forest Economics, Swedish University of Agricultural Sciences (SLU), Umeå. Reference number: P6

Paulrud, Anton and Dalin, Per-Eric (2001), ”Sportfisket i Kaitum – en rapport om sportfiskarna, sportfisket och dess samhällsekonomiska värde”. Arbetsrapport 305, Department of Forest Economics, Swedish University of Agricultural Sciences (SLU), Umeå. Reference number: P3

Paulrud, Anton and Thomas Laitila (2003), “Valuation of Management Policies for Sport-Fishing on Sweden's Kaitum River”. Arbetsrapport 335, Department of Forest Economics, Swedish University of Agricultural Sciences (SLU), Umeå. Reference number: P4

Sandstöm, Mikael (1996), “Recreational benefits from improved water quality: A random utility model of Swedish seaside recreation”. Working Paper No 121, Working Paper Series in Economics and Finance, Stockholm School of Economics. Reference number: S1

Schéele, Siv and Riitta Sorsa (1996), ”Stockholmarnas syn på Bromma flygplats 1996 jämfört med 1993”. Inregia AB (Institute for regional analysis), Stockholm. Reference number: S9

SIKA (1999), Översyn av samhällsekonomiska kalkylprinciper och kalkylvärden på transportområdet. Redovisning av regeringsuppdrag juni 1999. SIKA report 1999: 6, Swedish Institute for Transport and Communication Analysis, Stockholm. Reference number: S18

SIKA (2002), Översyn av samhällsekonomiska kalkylprinciper och kalkylvärden på transportområdet. SIKA report 2002:4, Swedish Institute for Transport and Communication Analysis, Stockholm. Reference number: S19

SIKA (2003), ”Trafikens externa effekter – Uppföljning och utveckling 2002”. SIKA report 2003:1, Swedish Institute for Transport and Communication Analysis, Stockholm. Reference number: S24

SIKA (2003), “Internalisering av godstrafikens externa effekter”. SIKA report 2003:6, Swedish Institute for Transport and Communication Analysis, Stockholm. Reference number: S25

Silvander, Ulf (1991), ”Betalningsvillighetsstudier för sportfiske och grundvatten i Sverige”. Dissertations 2, Department of Economics, Swedish University of Agricultural Sciences, Uppsala. Reference number: S2 (a,b)

Silvander, Ulf and Lars Drake (1991), ”Nitrate Pollution and Fisheries Protection in Sweden”, In Nick Hanley (ed.), *Farming and the Countryside: An Economic Analysis of External Costs and Benefits*. CAB International, Oxon, England. Reference number: S20

Skåneberg, Kristian (1994), ”En beräkning av skogsförsurningens skadekostnader”. Appendix to The National Institute of Economic Research and Statistics Sweden, *Svenska miljöräkenskaper: En lägesrapport*. Stockholm. Reference number: S10

SOU, Sveriges Offentliga Utredningar 1992:56, *Färjor och farleder*. Ministry of infrastructure (Kommunikationsdepartementet), Stockholm. Reference number: S23

Soutukorva, Åsa (2001), “The value of improved water quality – A random utility model of recreation in the Stockholm archipelago”. Beijer Discussion Papers Series No. 135, The Beijer International Institute of Ecological Economics, The Royal Swedish Academy of Sciences, Stockholm. Reference number: S11

Sundberg, Sara (2003), “Att värdera miljön genom ersättningskostnader – en granskning av metoden och tillämpning på havsöringshabitat”. Master Thesis in economics 306, Department of Economics, Swedish University of Agricultural Sciences (SLU), Uppsala. Reference number: S21

Sundqvist, Thomas (2002), “Quantifying household preferences over the environmental impacts of hydropower in Sweden: A choice experiment approach”, In *Power Generation Choice in the Presence of Environmental Externalities*. Doctoral thesis, 2002:26, Department of Business Administration and Social Sciences, Luleå University of Technology. Reference number: S16

Sundqvist, Thomas (2002), “Quantifying non-residential preferences over the environmental impacts of hydropower in Sweden: A choice experiment approach”, In *Power Generation Choice in the Presence of Environmental Externalities*. Doctoral thesis, 2002:26, Luleå University of Technology. Reference number: S17

Svedrup, H., P. Warfvinge and Bengt Nihlgård (1994), “Assessment of Soil Acidification Effects on Forest Growth in Sweden”. *Water, Air and Soil Pollution*, 78, 1-36. Reference number: S3

Svedsäter, Henrik (1996),” Willingness to Pay for an Environmentally Protective Engine - a Contingent Valuation Study”. Master Thesis 1996:4, Unit for Environmental Economics, Department of Economics, Gothenburg University. Reference number: S15

Söderqvist, Tore (1987), ”Miljöavgifter och pantsystem för kvicksilverhaltiga batterier”. Master thesis in economics, Stockholm School of Economics. Reference number: S13

Söderqvist, Tore (1995), “Benefit Estimates from Market Studies and Contingent Valuation Studies: An Empirical Comparison for the Case of Residential Radon Radiation”. Beijer Discussion Paper Series No 58, The Beijer International Institute of Ecological Economics, The Royal Swedish Academy of Sciences, Stockholm. Reference number: S6

Söderqvist, Tore (1995), “Estimating the Benefits of Health Risk Reduction: The Contingent Valuation Method Applied to the Case of Residential Radon Radiation”. Beijer Discussion Paper Series No 57, The Beijer International Institute of Ecological Economics, The Royal Swedish Academy of Sciences, Stockholm. Reference number: S5

Söderqvist, Tore (1995), “Property Values and Health Risks: The Willingness To Pay for Reducing Residential Radon Radiation”. *Scandinavian Housing and Planning Research*, 12, 141-153. Reference number: S4

Söderqvist, Tore (1995), “The Value of Saving a Statistical Life in the Case of Residential Radon Risks: Estimates and Determinants”. Beijer Discussion Paper Series No 59, The Beijer International Institute of Ecological Economics, The Royal Swedish Academy of Sciences, Stockholm. Reference number: S7

Söderqvist, Tore (1996), “Contingent Valuation of a Less Eutrophicated Baltic Sea”. Beijer Discussion Paper Series No. 88, The Beijer International Institute of Ecological Economics, The Royal Swedish Academy of Sciences, Stockholm. Reference number: S8

Söderqvist, Tore (1996), “Ekonomisk värdering av miljön: Metoder och svenska erfarenheter”, p 5-73, In *Expertrapporter från Skatteväxlingskommittén*, SOU 1996:117, Minstry of Finance, Stockholm. Reference number: S22

Söderqvist, Tore (2000), “Natural Resources Damage from Chernobyl: Further Results”. *Environmental and Resource Economics*, 16, 343-346. Reference number: S12

Söderqvist, Tore and Henrik Scharin (2000), “The regional willingness to pay for reduced eutrophication in the Stockholm archipelago”. Beijer Discussion Papers Series No. 128, The Beijer International Institute of Ecological Economics, The Royal Swedish Academy of Sciences, Stockholm. Reference number: S14

Toivonen, A-L., Appelblad, H., Bengtsson, B., Geertz-Hansen, P., Gudbergsson, G., Kristofersson, D. Kyrkjebo, H., Navrud, S., Roth, E., Tuunainen, P. and Weissglas, G. (2000), "Economic value of recreational fisheries in the Nordic countries". TemaNord 2000:604. Nordic Council of Ministers, Köpenhamn. Reference number: T2

Transek AB (2001), "Trafiksystemens intrång i boendemiljöer - Värdering av god miljö i pengar". Transek AB, Solna. Reference number: T3 (a, b, c)

Trouvé, Johan and Jan Owen Jansson (1987), "Värdering av miljökostnader av en ny väg – en fallstudie av planerad motorväg på vägbank over Ljungskileviken". VTI Notat T07, The Swedish National Road and Transport Research Institute (VTI), Linköping. Reference number: T1

Vredin, Maria (1994), "Valuing a Peripheral Environmental Amenity: The Swedes' Willingness to Pay for the Survival of the African Elephant", In Maria Vredin, *The African Elephant – Existence Value and Determinants if Willingness to Pay*. Umeå Economic Studies No. 441, Umeå University. Reference number: V1

Werneman, Peter (1997), "Vad är det ekonomiska värdet av en kvalitetsförändring i fågelsången? - Contingent Valuation Method som ekonomisk värderingsmetod av vägintrångskostnader". Report 107, Swedish University of Agricultural Sciences (SLU), Department of Economics, Uppsala. Reference number: W1

Widlert, Staffan, Gunnar Lind, Esbjörn Lindqvist, Johanna Lindqvist and Ulrika Lindstedt (1993), "Värdering av miljöfaktorer". Transek, Solna. Reference number: W5

Wilhelmsson, Mats (2000), "The Impact of Traffic Noise on the Value of Single-Family Houses", In *Trafic Noice and Property Values*. Memorandum 5:50, Doctoral thesis, Department of Real Estate and Construction Management, Royal Institute of Technology, Stockholm. Reference number: W2

Wilhelmsson, Mats (2000), "Valuation of Traffic-Noise Abatements", In *Trafic Noice and Property Values*. Memorandum 5:50, Doctoral thesis, Department of Real Estate and Construction Management, Royal Institute of Technology, Stockholm. Reference number: W3

Wilhelmsson, Mats (2000), "Trafikbuller och fastighetsvärden", In *Trafic Noice and Property Values*. Memorandum 5:50, Doctoral thesis, Department of Real Estate and Construction Management, Royal Institute of Technology, Stockholm. Reference number: W4

Åkerman, Jeanette (1988), ”Economic valuation of risk reduction: the case of indoor radon”. Research Report, The Economic Research Institute, Stockholm School of Economics. Reference number: Å2

Åkerman, Jeanette, F. Reed Johnson and Lars Bergman (1991), “Paying for Safety: Voluntary Reduction of Residential Radon Risks”. *Land Economics*, 67, no 4, 435-446. Reference number: Å1

Appendix 2

Summaries of primary valuation studies on environmental change in Sweden

- **Andersson, Åsa (1994), "Estimating the Potential Ecological Retention/Elimination Service Performed by Natural Wetlands in the Baltic Sea Drainage Basin". Master thesis 1994:9, Department of Systems Ecology, Stockholm University.**

Reference number: A1

The value of the nitrogen retention/elimination service provided by wetlands was estimated with the use of the replacement cost method. The cost of replacing the service provided by wetlands in the Baltic Sea drainage basin with sewage treatment plants was calculated. The replacement cost amounts to 1200-1600 million SEK for the Baltic Sea drainage basin.

- **Appelblad, Håkan (2001), "The Spawning Salmon as a Resource by Recreational Use. The case of the wild Baltic salmon and conditions for angling in north Swedish rivers". Doctoral thesis, GERUM 2001:3, Department of Social and Economic Geography, Umeå University.**

Reference number: A5

As a part of this doctoral thesis, a survey was distributed to anglers who had been fishing in the River Byske in 1996. The survey contained a valuation part with questions about the respondent's willingness to pay for fishing in the river under current conditions and under improved conditions. Addresses were registered when anglers bought fishing licences. In 1997, the mail questionnaire was sent to 192 Swedish anglers and the final response rate was 71%. The respondent was asked about her/his maximum willingness to pay before she/he decided not to go fishing. The payment vehicle used was the cost of the fishing licence (one-day, weekly, yearly). Ten intervals, ranging from SEK 0 to 499, for the one-day licences were presented and if the respondent had a higher WTP she was asked to state that in an open-ended question. A similar question was used for the weekly licence, but with 20 intervals ranging from SEK 0 to 999. For the yearly fishing licence an open-ended question was used. The first question concerned the current conditions in the River Byske and the second question concerned an improved situation when the standard would be similar to good Norwegian salmon rivers. The obtained result was a mean willingness to pay for fishing licence under current conditions in the River Byske at SEK 89 for day licence, SEK 326 for week licence and SEK 757 for year licence. If the conditions were as in good Norwegian rivers the mean WTP was estimated at SEK 142 for day licence, SEK 522 for week licence and SEK

1231 for year licence. The consumer surplus was also calculated, base only on salmon anglers. The mean CS was SEK 38 per angler and SEK 18 per day.

- **Azar, Christian and Johan Holmberg (1995), "Defining the generational environmental debt".** ***Ecological Economics*****, 14, 7-19.**

Reference number: A3

The Swedish generational environmental debt was calculated for anthropogenic emissions of CO_2. The present generation can either restore the damage or compensate future generations for the damage we have caused. The generational environmental debt is defined as the measure of these costs. The Swedish environmental debt for carbon dioxide emissions amounted to 60 billion US dollars.

- **Bojö, Jan (1985). "Kostnadsnyttoanalys av fjällnära skogar: Fallet Vålådalen". Research Report, The Economic Research Institute, Stockholm School of Economics.**

Reference number: B1

Both the contingent valuation method and the travel cost method were applied in this study. The estimated value of protecting the Vålådalen, as a natural reserve, was used in a cost-benefit analysis. The survey was carried out in the period of February to April 1985 and a number of 282 households were interviewed while visiting the Vålådalen in the county of Jämtland. The sample was non-randomly selected. The interviews were conducted on-site and a response rate of 96% was reached. The WTP question was formulated as a bidding game, where the first bid was SEK 1 and the highest bid SEK 100. A daily fee for visiting the proposed natural reserve was used as the payment vehicle. The willingness to pay per person and day was modelled as a function of household income per capita or household income, environmental preferences, activity carried out in the Vålådalen, number of previous visits, dummy variable for interviewer, dummy variable for the order of the bids in the bidding game and an error term. The mean willingness to pay per day was estimated at SEK 27 and the median was SEK10. The total willingness to pay amounted to 1.026 million SEK per year.

A travel cost analysis was also carried out. The following demand function was estimated:

$$Hi = f\left(Ci, y_i, S_i, D_{i,} e_i\right)$$

where

Hi = visitor from zone i divided by the population of zone i
Ci = Travel cost per household member from zone i to Vålådalen and back
Yi = average income in zone i
Si = substitute sites for recreation
Di = dummy for means of transportation

The alternative cost of time was not included in the travel cost variable. The total consumer surplus was estimated to be approximately SEK 700,000 with an average per visitor of SEK 150-200. These figures were adjusted by taking into account groups that previously were excluded from the sample, such as people travelling by bus or train. Based on this adjustment the total consumer surplus per year amounted to approximately 1.4 million SEK per year. The loss of consumer surplus due to forest harvesting was amounted to .0.91 million SEK per year.

- **Boman, Mattias and Göran Bostedt (1997), "Valuing the wolf in Sweden: Are benefits contingent upon the supply", In Bostedt, Göran, *Public goods in Swedish forests. Essays on nonmarket valuation and environmental policy*. Doctoral thesis, Silvestria 34, Department of Forest Economics, Swedish University of Agricultural Sciences, Umeå.**

Reference number: B5

The contingent valuation method was applied to estimate the benefits of different wolf population levels in Sweden. A mail questionnaire was sent to a random sample of 2500 Swedish citizens, in the age between 17 and 74 years, during late 1993 and early 1994. The questionnaire included an open-ended WTP-question as well as a discrete choice WTP-questions. In the DC-question a bid vector containing five bids was used (SEK 20, 100, 500, 1500, 5000) in combination with four levels of the wolf population (25, 100, 700, 1000 wolfs). In addition, respondents who stated they had no positive WTP were asked about their WTA in an open-ended question. The response rate of the survey was 61%. A contribution to a project guaranteeing the survival of the wolf population was used as the payment vehicle. The estimated mean WTP for the survival of the wolf population in Sweden ranged between SEK 700-900, depending on the model specification, based on the DC-question and SEK 365 based on the OE-question. The corresponding median WTP was SEK 100-200 and SEK 100 respectively for DC and OE. Few respondents stated strictly positive WTA.

- **Boonstra, Froukje (1993), "Valuation of ski recreation in Sweden – a travel cost analysis". Umeå Economic Studies, No 316, University of Umeå.**

Reference number: B6

The travel cost method was applied to estimate the consumer surplus of for ski recreation in Sweden. Data was obtained from the Tourism and Travel Database (TDB). The TDB data is derived from monthly interviews with a random sample of the Swedish population in the ages from 0 to 74 years. People who had made one or two skiing trips during 1992 were selected from the database. This gave a sample of 300 observations on trips made by 279 different households. The demand for ski recreation is estimated according to the following function:

$$TLj = f(TC2_j, N_i, AG_i, CH_i, Y_i, OV_i, ED_i, TR_i, BU_i)$$

where

TLj = Total number of skiing trips form zone j divided by the population of zone j
TC2j = proxy for the travel cost faced by household i
Ni = Number of members from household i who made a skiing trip
AGi = Average age of household i
CHi = Number of persons under the age of 12 years old in household i
Yi = Income rating for household i
OVi = Total number of overnight stays for household i
EDi = Education rating for responding household member
TRi = Dummy for household who travelled by train
BUi = Dummy for household who travelled by coach bus

The travel cost (TC2j) consists of the average distance travelled times a kilometre price, containing both travel and time costs. The time costs are based on one third of the wage rate.

The total consumer surplus for ski recreation in Sweden during 1992 amounted to 486 million SEK and the average benefits for a person making a skiing trip were estimated to be SEK 312.

- **Bostedt, Göran and Leif Mattsson (1991), ”Skogens betydelse för turismen: En samhällsekonomisk pilotstudie”. Arbetsrapport 141, Department of Forest Economics, Swedish University of Agricultural Sciences, Umeå.**

Reference number. B3

The contingent valuation method was applied to estimate a value of the forest for tourism recreation. The study was carried out in the area of Risnebo in the county of Småland, Sweden. The questionnaires were distributed to visitors at campsites and other personal accommodations. A number of 180 questionnaires were distributed to Swedish tourists in the study area. The response rate was 30 %. In addition, questionnaires were also handed out to foreigner visitors and to tourists in Ma-

lingsbo-Kloten in Bergslagen. The response rate was however to low and the data was therefore not completely analysed. A mean WTP of SEK 5,689 per household was obtained for a visit in the area of Risebo. The payment vehicle used was a one-time payment. The respondents were also asked about their willingness to pay for preserving the quality of the forest. The resulting mean WTP was SEK 2,680. Four linear regression models with WTP as dependent variable were estimated. The independent variables used: travel distance, number of persons in the household, part of experience derived form Risebo area, part of experience of Risebo derived from the forest, household income, part of experience derived from fishing and the probability of returning to the area.

- **Bostedt, Göran and Leif Mattsson (1995), "The Value of Forests for Tourism in Sweden". *Annals of Tourism Research*, 22, 671-680.**

Reference number: B4

This contingent valuation study was carried out in two tourism areas in Sweden, Harasjömåla in the southern part of the country and Arjeplog in the northern part of the country. In 1992, during the period July-August, staff at the tourism reception centres in the study areas handed out questionnaires to ever fifth visiting household. A number of 236 questionnaires were distributed in Harasjömåla and 240 in Arjeplog. The respondents were asked about their willingness to pay for visiting the area and also how much of the area's value that was assignable to the experience of the forest characteristics. An open-ended format of the WTP-question was used. The resulting mean WTP was SEK 2,367 per household for visits of the Harasjömåla area. The value derived from forest nature in that area was SEK 386 or 16% of the value of the visit. For a visit in the Arjeplog area a mean WTP of SEK 3,050 was estimated and the value of the forest nature amounted to SEK 418 or 14% of the value of the visit. The respondents were also asked about their preferences regarding forest attributes and how these attributes would change their willingness to pay for the tourist trip. A regression analysis was made with the increase in WTP value of the tourist trip as dependent variable. The following explanatory variables were used (all are dummy variables): stand density more and less, proportion of broad leaved trees more or less, size of clearcuts big/few and small/many, tree age older and younger, and accessibility of the forest increased/more people and decreased/fewer people.

- **Carlsson, Fredrik, Peter Frykblom and Carolina Liljenstolpe (2001), "Valuing wetland attributes – an application of Choice Experiment". Working Paper Series 2001:3, Department of Economics, Swedish University of Agricultural Sciences (SLU), Uppsala. (Forthcoming Ecological Economics)**

Reference number: C2

Individuals' marginal willingness to pay for different attributes of a wetland is estimated with the use of choice experiments. The study concerns a wetland area in Staffanstorp in the southwest part of Sweden, where the municipality has proposed that a wetland should be developed. The respondents of the choice experiment were individuals between 18-75 years living in Staffanstorp. A random sample of 1200 individuals was made. The survey was conducted in May 2001. The response rate was 48 % (580 individuals) but due to non-responses only 468 questionnaires were used for the analyses, which gives a final response rate of 39%. Each respondent answered 4 choice sets and in each set they were asked to choose between three alternatives, of which one was the status quo alternative. The following seven attributes, with the levels within parenthesis, were used to describe the wetland area: total cost (SEK 200, 400, 700, 850), surrounding vegetation (forest, meadow), biodiversity (low, medium, high), fish (no actions, good condition), fenced waterline (no, yes), crayfish (yes, no introduction) and walking facilities (no, yes). Both a standard conditional logit model and a random parameter logit model were estimated. The marginal willingness to pay (SEK) for the different attributes are according to logit model; high biodiversity 673.22; medium biodiversity 504.58; fish 348.48; fenced waterline -167.53; crayfish -113.48; walking facilities 648.06. The marginal willingness to pay for the different attributes are according to random parameter model; high biodiversity 751.38; medium biodiversity 518.55; fish 346.51; fenced waterline -345.66; crayfish -263.78; walking facilities 511.14.

- **Carlsson, Fredrik and Peter Martinsson, (2001), "Do Hypothetical and Actual Willingness to Pay Differ in Choice Experiments? - Application to the Valuation of the Environment". *Journal of Environmental Economics and Management,* Vol. 41, pages 179-192.**

Reference number: C4

In this study a hypothetical and an actual choice experiment were conducted. The objective was to test the feasibility of applying choice experiments to donations for environmental projects. The respondents were asked to make pair wise choices between alternatives described by three attributes: the amount of money the respondent received, the donation paid to an environmental project and the type of environmental project. Three different environmental projects, managed by the World Wildlife Foundation (WWF), were used: the rainforest, the Baltic Sea and the Mediterranean. Each respondent answered 16 choice sets in both the hypothetical and the actual experiment. Respondents were recruited among students in economics at Göteborg University and Karlstad University. Participation was voluntary and 35 students chose to participate. The students were first given a questionnaire about socio-economic factors and their attitude and knowledge about the environment, than the hypothetical experiment and last the actual experiment. The marginal willingness to pay for donations was calcu-

lated as the ratio between the coefficient for donations and the coefficient for money.

- **Carlsson, Fredrik and Olof Johansson-Stenman (2000), "Willingness to pay for improved air quality in Sweden".** ***Applied Economics*****, 32, 661-669.**

Reference number: C3

The contingent valuation method is applied to value the willingness to pay for increased air quality in Sweden. The survey was a part of the larger Household Market and Nonmarket Activities (HUS) survey conducted in 1996. The survey was addressed to respondents of the HUS survey conducted in 1993 and to young individuals in the panel households. The young respondents were first interviewed personally. The other respondents were first interviewed by telephone and then they received a self-enumerated questionnaire by mail. The sample size was 3240 individuals in 1922 households. About 96% (3107 individuals) answered the valuation question. The environmental section of the survey contained an open-ended question about maximum WTP to reduce the concentration of harmful substances by 50 % where the respondents live and where they work. The payment vehicle used was a charge related to individual income, which would affect everybody in the area. The mean WTP was 156 SEK/month; the median WTP was 100 SEK/month and the standard deviation 286 SEK. Three models with WTP as dependent variable were estimated. The following independent variables were included: individual income, partner income, household wealth, number of children, education, serious disease, pollution knowledge, retired, member of an environmental organisation, big city, house owner, nature knowledge, age and nature important for stated WTP. The equations also include a constant, a dummy variable for positive partner income, a dummy variable for low income and an income variable for low income.

- **Cravener, Martin (1995), "Samhällsekonomisk värdering av den anlagda våtmarken i Oxelösund. En tillämpning av Contingent Valuation-metoden". Master thesis, Department of Economics, Stockholm University.**

Reference number: C1

The value of the constructed wetland area in Oxelösund, Sweden, was estimated with the use of the Contingent Valuation method. In 1994 a mail questionnaire was sent to a random sample of 371 residents, in the age of 18 years or older, in Oxelösund. The respondents were asked about their willingness to pay for the preservation of the wetland area. The payment card format was used in the WTP-question, with a starting bid of SEK 500. An open-ended WTP question was also provided as a complement. A one-time payment to support the preser-

vation was used as the payment vehicle. The response rate was 56%. The estimated mean WTP ranged between SEK 171-374. A median WTP of SEK 0 / 250 was obtained, depending of the treatment of non-respondents. A multiple regression of the willingness to pay was estimated with age, education and income as independent variables.

- **Dalin, Per-Eric (2000), "Småviltsjakten på statens mark ovan odlingsgränsen - en samhällsekonomisk analys". Arbetsrapport 296, Department of Forest, Swedish University of Agricultural Sciences (SLU), Umeå.**

Reference number: D5

The travel cost method was applied to estimate the consumer surplus from the small game hunting on public owned land in the mountains of Villhelmina community. A questionnaire was sent to Swedish hunters who visited Villhelmina community between August 20 and September 25, 1999. Only hunters that were using daily hunting permits were included in the study. The questionnaire was also sent to those who joined these hunters on their hunting trips. In total 270 persons received the questionnaire. The response rate was 85%. The total consumer surplus of small game hunting in Villhelmina community between August 25 and September 25 was SEK 186 325 and the consumer surplus per hunting day was SEK 82. The consumer surplus for hunters is also presented separately (SEK 91 per day).

The demand was estimated according to the following function:

$$\ln V_i = \alpha + \beta_1 TC_i + \beta_2 FJ_i + \beta_3 RJ_{ij} + e_i$$

Where

V_i = travel frequency from zone i
TC_i = cost per hunting day in zone i
FJ_i = supply of small game hunting in zone i
RJ_{ij} = substitutes for Villhelmina community in zone i
e_i = error term
i = zone i
j = visit area

The alternative cost of time was included in the variable TCi, cost per hunting day, as one third of the wage rate.

- **Drake, Lars (1992), "The non-market value of the Swedish agricultural landscape". *European Review of Agricultural Economics*, 19, 351-364.**

Reference number: D6

The contingent valuation method was applied to value the Swedish agricultural landscape. A random sample of Swedish citizens was selected to participate in the study. In 1986 a number of 1089 interviews was conducted. The respondents were asked about their willingness to pay for preventing that half of all agricultural land would be cultivated with spruce forest. A paying card procedure, with 15 bids ranging from 0 to 3000 SEK/year, was used. Income tax was used as the payment vehicle. A mean WTP of SEK 468 per person and year was estimated. The corresponding median WTP was SEK 200. The total WTP amounted to approximately SEK 3.4 billion. A value per hectare agricultural land was also calculated to approximately 975 SEK/hectare and year. A regression analysis of the willingness to pay was estimated with the following explanatory variables: household income, age, level of education, the respondent's ranking of profitability and other values in the agricultural production, and attitudes towards preserving the agricultural landscape.

- **Drake, Lars, Kal-Ivar Kumm and Mari Andersson (1991), "Har jordbruket i Rottnadalen någon framtid? En analys av landskapsvärden och företagsekonomiska kostnader". Småskriftserien no 48, Department of Economics and Statistics, Swedish University of Agricultural Sciences, Uppsala.**

Reference number: D4

The contingent valuation method was applied to estimate a value of the agricultural landscape in Rottnedalen, Sunne municipality, in the county of Värmland. Both mail questionnaires and personal interviews were used to gather data. A sample of 92 house-owners in the study area was selected to participate in the study. The response rate was 65%. A number of 49 personal interviews were conducted and 11 persons responded by mail. The respondents were asked about their annually willingness to pay, as an increase in local taxes, to compensate farmers in the area for preserving the agricultural landscape. An annual mean WTP of SEK 540 per person was obtained. A regression analysis of the willingness to pay was estimated with income, age, sex, born in the area, permanent resident and level of education as independent variables.

- **Ek, Kristina (2002), "Valuing the Environmental Impacts of Wind Power – A Choice Experiment Approach". Licentiate thesis, 2002:40, Luleå University of Technology.**

Reference number: E2

The objective of this choice experiment study was to estimate the value of the environmental attributes associated with wind power generation. The survey was sent to 1000 randomly selected Swedish house owners in 2002. The response rate of the survey was 56%. Each respondent were asked to choose between two wind- power

alternatives in six choice sets. The following five attributes were included in the choice experiment: noise (dB 30, 40), location (mountain, offshore, onshore), height (higher than 60 meters, otherwise), group (small, large separate), price (6 levels ranging between -10 öre/kWh and +15 öre/kWh). A random effects binary Probit model, pooled by individual was estimated. The following explanatory variables were included: noise, location: mountain, location: off-shore, height, small group, large group, large group located offshore, small group located in mountainous area, visit mountains, price change per kWh, member of an environmental organization, windmill near residence, age and choice based on what is best for society. The implicit prices for the different attributes were calculated and interpreted as the marginal willingness to pay or willingness to accept a change from the status quo level of the attribute. The obtained implicit prices, expressed in öre/kWh, for the different attributes were: noise (0.67), mountain (-2.18), offshore (3.47), height (0.26), small (1.55), large (-1.64).

- **Fahlgren, Louise and Helena Knutsson (2001), ”En sluss till värdering av Göta Kanal – en studie av fastighetspriser”, [A study of real estate prices alongside Göta Canal]. Master thesis in economics, Forskning från Linköpings universitet; 8, Linköping University Electronic Press.** (www.ep.liu.se/ea/gotakanal/2001/008/)

Reference number: F7

The objective of this master thesis is to study whether the willingness to pay for a public good is reflected in the real estate prices. Both the contingent valuation method and the hedonic price method were applied. The contingent valuation method was applied to estimate the willingness to pay for living closer to the canal. Data was gathered in July 1999 as a part of another study. A number of 56 personal interviews were conducted at six locations along the canal. The willingness to pay for living closer to the canal ranged between 1 200- 12 000 SEK per year. It was not possible to derive more precise estimates due to the small sample and the method used to gather data.

In the hedonic price study real estates sold in the area during the time period January 1996 to May 1999 were studied. The data set consisted of 1300 sales prices. Four different models were estimated, linear, semilog linear, inverse semilog linear and loglinear. The following variables were included in the models: distance to the canal, lot size, living area, age, waterfront, Norrköping, Linköping, Motala, Karlsborg, Töreboda and Mariestad. The marginal hedonic price ranged between 20 to 33 SEK depending on the functional form used. The linear function resulted in a marginal hedonic price of 20 SEK per meter up to 2000 meter from the canal. The semilog linear function resulted in a hedonic price of 25 SEK per meter. The inverse semilog linear function resulted in a marginal hedonic price of 33 SEK per meter. The loglinear functional form resulted in a marginal hedonic price of 29 SEK per meter. The marginal he-

donic price was interpreted as the individual's willingness to pay for having her/his house located one meter closer to the canal.

- **Folke, Carl (1991), "The Societal Value of Wetland Life-Support", p. 141-171 In Carl Folke and Tomas Kåberger (eds.),** ***Linking the Natural Environment and the Economy: Essays form the Eco-Eco Group*****. Kluwer Academic Publishers, Dordrecht.**

Reference number: F2

This study focuses on ecosystem services provided by wetlands, such as cleansing nutrients and pollutants, maintaining the level and quality of the drinking water, processing sewage, serving as filter to coastal waters, sustaining genetic diversity and preserving endangered species. The value of the ecosystem services lost due to exploitation of Martebomire on the island of Gotland was estimated with the use of the replacement cost method. The cost of providing the ecosystem services with man-made substitutes, such as irrigation dams, water transportation, well-drilling, sewage treatment plants, fertilizers and fish farming, was calculated. However, it was not possible to find substitutes for all ecosystem services and consequently some of the services, such as species diversity and recreation, were not included in the valuation. The total replacement cost amounted to about 2.5-7 million SEK per year.

- **Fredman, Peter (1995), "Endangered Species: Benefit Estimation and Policy Implications". Report 109, Department of Forest Economics, Swedish University of Agricultural Sciences, Umeå.**

Reference number: F1

The benefits of the white-backed woodpecker in Sweden were estimated in a contingent valuation survey. In 1993, a mail questionnaire was sent to a random sample of 3360 Swedish citizens, aged between 17 and 74 years. A number of 2880 individuals received questionnaires with a discrete choice WTP-question and 480 received an open-ended WTP-question. Only the result derived from the discrete choice data was considered in this study, for the result from the OE-question se reference number L5. The response rate was 60%. The DC-question contained a bid vector including six bids (SEK 10, 50, 100, 300, 500, 2000). A regression analysis was estimated including the following variables: time for returning the questionnaire, area of living, size of the city/town where the respondent lives, age, sex, level of education, time spent in outdoor activities during leisure time, importance of environmental issues in society, reasons for preserving the white-woodpecker, information given in the questionnaire, income per person in the household and population density. The overall mean WTP was calculated at SEK 10,650. However, if it was assumed that none of the respondents had a higher value than the highest bid if SEK 2000, the mean WTP was equal to SEK 406. The median WTP was estimated at SEK 466.

- **Fredman, Peter and Lars Emmerlin (2001), "Wilderness purism, willingness to pay and management preferences: a study of Swedish mountain tourists". *Tourism Economics*, 7, 5-20.**

Reference number: F4

The contingent valuation method is applied to estimate the maximum willingness to pay for at trip to the Femundsmarka-Rogen-Långfjället mountainous area. The study area is located on both sides of the Swedish-Norwegian border. In 1998, from June to September, visitors in the area were asked to fill in a registration card with their name and address at twenty self-registration boxes. A sample of 1016 individuals was selected from the 3342 registered Swedish visitors. A mail questionnaire, with an open-ended question about the respondents' maximum willingness to pay for a trip to the study area, was distributed about six month after the visit. The response rate of the mail questionnaire was 74.4%. The sample was divided into three visitor segments, (purists, neutralists and urbanists) according to their attitudes towards management of wilderness areas. The average willingness to pay for the experience of the area was 1756 SEK. The average consumer surplus of a visit in the study area was estimated at 520 SEK. The maximum amount respondents were willing to pay before they decided not to undertake the trip was 4058 SEK. WTP for the trip and WTP and CS for the visit are also presented separately for the purist, neutralist and urbanist segments. A valuation function with the maximum willingness to pay for a visit in the area as a dependent variable was estimated:

$$y_i = \beta_0 + \sum_{j=1}^{3}\left(\beta_j X_{ij}\right) + \sum_{j=4}^{7}\left(\beta_j D_{ij}\right) + \varepsilon_j$$

Where X_{i1} to X_{i3} are continuous measures of distance to home, days in the study area and household income. D_{i4} to D_{i7} are binary variables equal to 1 if there was at least one previous visit to the study area (D_{i4}), if the visit constituted a good wildness experience (D_{i5}), if purist (D_{i6}) and if urbanist (D_{i7}).

The relative impact on WTP from different management changes was also estimated. The respondents were asked if they wanted either wider or smaller trails, either more or fewer encounters, facilities and restrictions.

- **Frykblom, Peter (1998), "Halved Emissions of Nutrients, What are the Benefits? - A Contingent Valuation Survey Applied to Laholm Bay", in *Questions in the Contingent Valuation Method - Five Essays*, doctoral thesis, Agraria 100, Department of Economics, Swedish University of Agricultural Sciences (SLU), Uppsala.**

Reference number: F3

The willingness to pay to reduce nutrient emissions by 50 % in Laholm Bay was estimated using the contingent valuation method. The questionnaire was in 1996 sent to 500 randomly selected residents, in the age between 18-75, in three communities surrounding the bay, Båstad, Halmstad and Laholm. The response rate was 67.4 %. The questionnaire contained a dichotomous choice question, with a bid vector containing five bids (SEK 20, 40, 100, 500, 250). The payment vehicle used was an increase of the monthly, community income tax. Mean annual WTP was SEK 747 and median annual WTP was SEK 244. A regression analysis of WTP with the following explanatory variables, sex, age, marital status, children, education, big city, medium sized city, respondent is a farmer and household income, was estimated.

- **Gren, Ing-Marie (1993), "Alternative Nitrogen Reduction Policies in the Mälar Region, Sweden". *Ecological Economics*, 7, 159-172.**

Reference number: G2

The value of wetlands as a nitrogen abatement technology was estimated. The costs of two alternative nitrogen reduction polices were calculated and compared for a reduction of the load of nitrogen to the Stockholm archipelago from the Mälar region. The current policy does not include wetlands as an abatement measure while the alternative policy does. The two policies were examined with respect to a specified environmental goal. The current policy was defined as a uniform reduction by 50% of the emission of nitrogen for all anthropogenic sources and the alternative policy was defined as a reduction by 50% of the anthropogenic load of nitrogen to the Stockholm archipelago. The value of the nitrogen abatement service provided by wetlands was estimated as the difference in cost between the two policies. The difference corresponds to SEK 32 per reduced kg of nitrogen or about SEK 3200 per hectare of wetland and year, given a denitrification rate of 100 kg per hectare and year.

- **Grudemo, Stefan (1987), "Förbifart Osbyholm (CVM-studie)". Working paper, The Swedish National Road and Transport Research Institute (VTI), Linköping.**

Reference number: G12

The objective of this ex post contingent valuation study was to estimate the willingness to pay for an alternative route of the motorway, E66. For this purpose, personal interviews with 10 households in the nearby area were conducted. The respondents were asked about their willingness to pay for the alternative route of the road preferred by the household. The resulting mean WTP was SEK 23,300 per household and the median WTP SEK 5,500 per household. In addition the respondents were also asked about their willingness to accept compensation for the degradation of the environment caused by the constructed

road. The resulting mean WTA was SEK 129,000 per household and mean WTA was SEK 50,000.

- **Grudemo, Stefan (1988), ”CVM-studie av intrång i rekreationsområde – fallstudie Klockartorpsleden i Västerås”. VTI Notat T29, The Swedish National Road and Transport Research Institute (VTI), Linköping.**

Reference number: G6

This contingent valuation study was carried out in 1987 to value the encroachment in a green area in Västerås caused by the motorway, E 18, which was finished in 1981. A random sample of households, in selected areas in Västerås, was sent a mail questionnaire. The sample was divided into three sub-samples, which were given alternative questionnaires. The questionnaire was sent to 204 households in sample (A), 103 households in sample (B) and 103 households in sample (C). The respondents were asked about their willingness to pay for the alternative of having the motorway in a tunnel. The response rate in (A) was 71%, in (B) 69% and in (C) 77%. The payment vehicle used in questionnaire (A) was a one-time payment, while in (B) + (C) an increase in local income tax was used. The questionnaires also differed in the type of valuation question used. In questionnaire (A) and (B) an open-ended WTP-question was used. In (C) the payment card format of WTP-question was instead used. The WTP was estimated separately for the three sub-samples. For (A), a mean WTP of SEK 464 per household and a median WTP of SEK 0 per household were obtained. For (B), mean WTP was estimated at SEK 372 per person and median WTP at SEK 0 per person. The estimated mean WTP in sub-sample (C) was SEK 376 per person and the median WTP SEK 200 per person.

- **Grudemo, Stefan (1988), ”CVM-studie av intrång i rekreations- och naturområde – fallstudie Säterivägen i Mölnlycke”. VTI Notat T47, The Swedish National Road and Transport Research Institute (VTI), Linköping.**

Reference number: G7

In 1981 a new road, Säterivägen, was constructed through an area with natural and recreational values in Mölnlycke. The contingent valuation method was applied in this study to estimate the willingness to pay for the alternative of instead having the road in a tunnel. In 1988, a mail questionnaire was sent to a random sample of 260 residents, in the age of 18 years or older, in Mölnlycke. The response rate was 68%. An increase in local income tax was used as the payment vehicle. Half the sample received an open-ended WTP-question and the other half received a WTP-question of payment card format. A mean WTP of SEK 371 and a median WTP of SEK 0 were obtained based on data derived

from the open-ended question. The payment card WTP-question resulted in a mean WTP of SEK 526 and mean WTP of SEK 200.

- **Grudemo, Stefan (1999), ”E6 genom Ljungskile – ett omstritt motorvägsbygge. Beskrivning av beslutsprocessen och invånarnas inställning och värdering av effekterna på närmiljön”. VTI meddelande nr 843, The Swedish National Road and Transport Research Institute (VTI), Linköping.**

Reference number: G9

This contingent valuation study follows up a previous valuation study (T1) of a planned motorway through the costal town of Ljungskile. This study was carried out after the motorway in Ljungskile was completed. Two different questionnaires were used and the respondents were randomly selected from the residents of Ljungskile, including the area Lyckorna. Questionnaire 1 was sent to 600 individuals, where 200 respondents received an open-ended WTP-question and 400 respondents received a discrete choice question with a bid vector that contained 4 bids (SEK 100, 200, 500, 1000). The questionnaire was distributed in December 1997 and the response rate was 74.2%. The respondents were asked about their willingness to pay for an alternative route of the motorway. The payment vehicle used in questionnaire 1 was an increase of the community tax for 10 years. The discrete choice question resulted in a mean WTP of SEK 228 and the open-ended question resulted in a mean WTP of SEK 63.

Questionnaire 2 contained a WTA-question and it was sent to 200 individuals in January 1998. The response rate was 71.9%. The respondents, who thought the quality of their local environment had deteriorated since the motorway was built, were asked to state their willingness to accept compensation for this deterioration. The compensation was a one-time payment. Only 19.5% of the respondents, i.e. 15 individuals, had experienced a deterioration of their local environment. A mean WTA of SEK 160 200 was obtained from their stated WTA.

- **Grudemo, Stefan (2000), ”CVM-studie av minskad trafik på Trelleborgsvägen i Malmö”. VTI notat nr 31 - 2000, The Swedish National Road and Transport Research Institute (VTI), Linköping.**

Reference number: G10

In this study the contingent valuation method is applied to estimate the willingness to pay for a decrease in traffic congestion on one distance of the motorway, E6, Trelleborgsvägen in Malmö. The study area was restricted to the part of the road between Lindeborgs trafikplats and Dalaplan and the surrounding areas,

Kulladal, Västra Söderkulla, Gröndal, Eriksfält and Heleneholm. In May 1997 the questionnaire was sent to 900 randomly selected individuals living in the study area. The response rate was 69.6%. A discrete choice question was used, with a bid vector containing 11 bids between 25 and 2000 SEK. An annual payment for 10 years in form of an increase of the municipal tax was used as the payment vehicle. The mean willingness to pay obtained was 714 SEK and the corresponding willingness to pay for the population was 2.5 million SEK.

- **Grudemo, Stefan, Pernilla Ivehammar and Jessica Sandström (2002), ”Beräkningsmodell för infrastrukturinvesteringars intrångskostnader”. VTI meddelande nr 939, The Swedish National Road and Transport Research Institute (VTI), Linköping.**

Reference number: G11

This report contains four case studies where a road or a railway constitutes a barrier between a lake or a sea and a community. The contingent valuation method has in these four cases been applied to estimate the willingness to pay for replacing the existing road or railway with a tunnel. A mail questionnaire with a discrete choice question was used in all cases.

(a) The first case study is the motorway, E4, along the shore of lake Vättern in the town of **Huskvarna**. In 1999 the questionnaire was distributed to a random sample of individuals between 18 and 75 years in (A) the adjacent area to the motorway in Huskvarna (B) the rest of Jönköping community. Two postcode areas were used to define area (A). The size of sub-sample (A) was 460 individuals and the response rate 78%. The size of sub-sample (B) was 2760 individuals and the response rate 65%. The following five different payment vehicles were used in this case study: an annually increase in tax for 10 years, a fixed charge per person for 10 years, a voluntary charge per person for 10 years, an annually increase in tax for 5 years and an increase in the monthly tax for 10 years. The obtained WTP per person was SEK 4185 per year for 10 years for the adjacent area and SEK 324 per person and year for 10 years in Jönköping community.

(b) The second case study is the road (länsväg 100) at **Höllviken** along Höllviken bay. In 2000 the questionnaire was distributed to a random sample of individuals between 18 and 75 years in (A) the adjacent area to the road (B) the rest of Hölleviken. All individuals in area (A) received the questionnaire, i.e. 242 individuals, and the response rate was 69.5%. The size of sub-sample (B) was 1200 individuals and the response rate was 73%. Half of the respondents in sub-sample (B) received a questionnaire with a payment vehicle in form of an increase of the municipal tax. For the other half the payment vehicle used was a charge. Two different payment vehicles were examined in the study,

increase in the municipality tax for 10 years and a fixed charge. An annual WTP of SEK 1841 per person was obtained for the adjacent area and SEK 273 for Hölleviken community.

(c) The third case study concerns the parallel road (riksväg 70) and railway through **Rättvik** along lake Siljan. This study was carried out in 2000. The questionnaire was sent to all 3000 individuals living in the city of Rättvik. Three different versions of the questionnaire were used. (A) 899 individuals were asked about their willingness to pay for having both the road and railway in a tunnel, response rate 63.5%. (B) 898 individuals were asked about their WTP of having just the road in a tunnel, response rate 59%. (C) 903 individuals were asked about their WTP of having only the railway in a tunnel, response rate 64%. An increase of the community tax for 10 years was used as the payment vehicle. The obtained annual WTP per person for 10 years was SEK 252 for replacing both the road and the railway with a tunnel, SEK 179 for replacing only the road with a tunnel and SEK 194 for replacing only the railway with a tunnel.

(d) The last case study concerns a road (riksväg 40) in **Ulricehamn**, which forms a barrier to a lake. This study was carried out in 2001. The respondents were divided into two sub-samples (A) individuals living in the area Villastaden adjacent to the road and (B) individuals living in the rest of Ulricehamn. The target population was individuals between 18-75 years. All 324 individuals in the target population living in the area Villastaden received the questionnaire and the response rate was 76%. In sub-sample (B) 1200 individuals were randomly chosen and the response rate was 71.5%. An increase in the community tax for 10 years was used as the payment vehicle. The obtained annual WTP per person was SEK 606 for the adjacent area and SEK 473 for the community.

- **Hammar, Thomas (1974), ”Trafikimmissioners inverkan på villapriser”. Mimeo, The Swedish National Road Administration, The County of Stockholm, (Vägförvaltningen), Solna.**

Reference number: H1

The objective of this study was to estimate the value of traffic noise. The study area was defined to Roslags-Näsby/Lahäll, on each side of the motorway E3, in Täby north of Stockholm. The study was based on a sample of sale prices for 118 houses, between 1970 and 1973 in the study area. A regression analysis was estimated, with house prices as dependent variable. Independent variables testes were: noise (dB), experienced noise, housing attributes, house located in Roslags-Näsby or in Lahäll and time of house purchase. A noise level of 71 dB decreases the value by 20% (SEK 47000), 64 dB decreases the value by 12%

(SEK 28000) and 60 dB decreases the value by 6% (15000) relative to the average house, with a value of SEK 240000, in the area. The values are expressed in the price level of 1973.

- **Hansson, Lars (1993), ”Vägtrafiken och det trafikpolitiska ansvaret”. Report, Department of Industrial Environmental Economics, Lund University.**

Reference number: H2

The objective of this study was to estimate an economic value of air emissions. The valuation was based on politically decided environmental charges of different airborne pollutants. The total value of carbon dioxide emissions amounted to 5600 SEK for the fiscal year 1992/1993 and the total value of other emissions amounted to SEK 9545 million for the same year.

- **Hasund, Knut Per (1997),”Documentation of Three Contingent Valuation Surveys on Preservation of Landscape Elements of Agricultural Land”. Småskriftserien no 107, Swedish University of Agricultural Sciences (SLU), Department of Economics, Uppsala.**

Reference number: H9

Three surveys made in 1989, 1991 and 1994 were summarized in this report. The contingent valuation method was applied to estimate the respondents’ willingness to pay for landscape elements. The same mail questionnaire was used in all three years. The questionnaire was sent to a random sample of 350, 200 and 300 Swedes in 1989, 1991 and 1994, respectively. The corresponding response rates of the questionnaires were 59%, 51% and 51%. The respondents were asked about their willingness to pay for protection of *all or almost all* landscape elements as well as for preservation of *half* of the threatened landscape elements. An open-ended WTP-question was used. An annual tax increase was used as payment vehicle. When outliners and protest-bidders were included the mean WTP was estimated at SEK 849 in 1989, SEK 932 in 1991 and SEK 669 in 1994. All values are given in the price level of 1994. When both outliners and protest-bidders instead were excluded the mean WTP was estimated at SEK 864 in 1989, SEK 772 in 1991 and SEK 626 in 1994. Regression models of WTP for landscape elements were estimated. The explanatory variables could be categorized in three classes: socio-economic, behavioural and attitude characteristics. The following variables were included: gender, resident in northern counties, resident in southern counties, income inflated into 1994-values, farmer, city, long education, age and a preference variable for the environment in general.

- **Hasund, Knut Per, Lennart Hedvåg and Håkan Pleijel (1990), ”Ekonomiska konsekvenser av det marknära ozonets påverkan på jordbruksgrödor”. Report 3862, The Swedish Environmental Protection Agency, Solna.**

Reference number: H4

This study estimates the value of yield losses to Swedish agriculture that are caused by ozone in the lower layers of the atmosphere. Calculations were made for grain, potatoes, grassland, oilseeds and sugar beet. Levels of ozone were measured from 1986 to1988. The ozone level during that period was used to evaluate the change in yield. The ozone pollution decreases the yields of all crops by about 9% on average. That corresponds to a yield loss of SEK 520 per hectare. The yield loss was evaluated on the basis of a Swedish price level. In total, the yield loss amounted to 1400 million SEK annually, with a probable range of 970-3300 million SEK/year, in 1988 prices. In addition, changes in yield levels were calculated for four scenarios: a reduction of 25% / 10% and an increase of 10% / 25% of the anthropogenously caused ozone concentration.

- **Heiter, Carsten (2000), “Using contingent valuation to measure preferences for the environment. An application to the National City Park Ulriksdal – Haga – Brunnsviken – Djurgården in Stockholm”. Master thesis, Department of Infrastructure and planning, Royal Institute of Technology, Stockholm.**

Reference number: H7

This study is an application of the contingent valuation method. The objective was to develop two valuation scenarios for estimating the benefits of preservation of an urban green space, the National City Park in Stockholm. The first scenario is called the “entrance fee scenario” and measures respondents’ WTP for recreational use of the green area. An entrance fee per visit was used as a payment vehicle. Visitors of the green sites of the Ekopark are defined as the target population for this kind of CVM study. The second scenario is called the “preservation fee scenario” and measures the total economic value from preservation. The target population in this kind of CVM study is inhabitants of Greater Stockholm. A pilot study was carried out in December 1996. The questionnaire was distributed to 170 staff members of the Royal Institute of Technology (KTH), Stockholm. The sample had been randomly chosen from KTH’s telephone catalogue. In addition the questionnaire was also distributed to 30 students, who had shown interest in taking part of the study, however without knowing the topic. A response rate of 28.5% was obtained in the pilot study. The mean WTP for an entrance fee per capita, in the entrance fee scenario, was SEK 12.4 for Södra Djurgården, 9.5 for Norra Djurgården, 12.6 for Haga and 10.5 for Ulriksdal. The mean WTP for an annual preservation fee per capita was SEK 332.3 for the core areas, 150.2 for the spreading corridors and 482.5 for the National City Park.

- **Heldt, Tobias (2000), ”Turskidåkarens värdering av externaliteter från skoter”. CTEK Working paper 2000:22, Dalarna University and National Institute of Road and Transport Research (VTI), Borlänge.**

Reference number: H11

This contingent valuation study was conducted in Grövelsjön, Dalarna during the Easter week in 2000. The study estimates skiers' value of the negative externality of snowmobiles. Personal interviews were conducted with 100 skiers at two different sites in the area. Every third skier passing the sites was asked to participate in the interview. The sites were suitable for a short brake. The respondents were asked about their WTP of separating the trails for skiers and snowmobiles. The WTP was interpreted as the value of the negative externality of snowmobiles. A double-bounded dichotomous choice questionnaire was used. Three different initial bids were used in the survey. The initial bids ranged from SEK 10 to 30. If the respondent accepted the first bid a higher bid was presented, if not a lower bid was presented. The payment vehicle used was a daily fee (dagkort) that is often used for downhill skiing. The mean WTP was estimated with the use of both a single-bounded model and a double-bounded model. Using the single-bounded model a mean WTP of SEK 21 per day was obtained. A 95% confidence interval is also provided and it ranges from 13.74 to 28.21. The double-bounded model resulted in a mean WTP of SEK 15 per day, with a 95% confidence interval between 8.08-21.56. The following valuation function was estimated:

$$WTP = C + \beta_0 BIDV + \beta_1 UTB + \beta_2 PROT + \beta_3 TUR + \beta_4 BO + \beta_5 INK + \varepsilon$$

Where C is a constant, BIDV represents the value of the first bid and UTB is the level of education (four different levels). PROT is a dummy variable that indicates protest answers, TUR represents how experienced the skier is (3 different categories), BO indicates the kind of accommodation and INK represents the household income.

- **Hjalte, Krister, Karl Lindgren, Anna-Lisa Thelander and Curt Wells (1982), ”Ekonomiska konsekvenser av vattenkvalitetsförändringar i sjöar”. Report TEM, Lund University.**

Reference number: H13

The travel cost method is applied to analyse the effects of recreational values due to changes in water quality. The lake Vombsjön situated in the southeastern part of the county of Malmöhus in southern Sweden was studied. The study was partly based on fictitious data. Three scenarios were considered: (1) decrease in the variation of the water level in the lake, (2) decrease eutrophication in the lake, (3) reduce the level of the lake and restore surrounding wetlands. The change in willing-

ness to pay for five recreational activities (bathing, boating, fishing, bird watching and general) was calculated for the three scenarios. Scenario 1 resulted in an increase in the willingness to pay of SEK 9,918, as a sum of all activities. The WTP increased by 12,411 for scenario 2 and SEK 55,976 for scenario 3.

- **Hougner, Cajsa (2003), "Samhällsekonomisk värdering av ekosystemtjänsten nötskrikans fröspridning i Stockholms nationalstadspark". Report, Centre for Research on Natural Resources and the Environment (CNM), Stockholm University.**

Reference number: H10

In this study the replacement cost method was applied to estimate the economic value of the ecosystem service provided by Jays. The study area is the National City Park in Stockholm, where jays contribute to the survival of the oak population by distributing seeds. The jay picks ripe acorns and buries them in the ground. The cost of planting oak seedlings or sowing acorns is estimated to establish an economic value of this ecosystem service. Sowing acorns (seeds) was found to be the cost effective replacement technique. The replacement cost amounted to approximately SEK 500,000. A sensitivity analysis was also made and it resulted in an interval of the replacement cost of SEK 301,000-862,000.

- **Hörnsten, Lisa and Peter Fredman (2000), "On the distance to recreational forests in Sweden". *Landscape and Urban Planning*, 51, 1-10.**

Reference number: H6

The contingent valuation method was applied to estimate the willingness to pay in order to avoid an increase in the distance between the residence and the closest recreational forest. In 1998 data was collected as a part of a larger survey on forest recreation. The questionnaire was sent to a sample of 1000 randomly selected individuals between 16 and 74 years of age, where 500 questionnaires contained the valuation question. The response rate was 48% for questionnaire 2 containing the WTP-question. An open-ended WTP question was used. The extent of the environmental change was an increase in distance to the individual's closest recreational forest, from the present to twice that distance. A logit model was applied:

$$L_i = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 D_{4i} + \beta_5 D_{5i} + \varepsilon_i$$

where X_2 is the present distance to the forest, X_3 age. D_4 and D_5 are dummy variables, D_4 is equal to 1 if income is larger than or equal to 19 000 SEK and D_5 is equal to 1 if female and 0 if male. L_i is the ratio of the probability that a respondent will have a WTP that is larger to 0 to the probability that the respondent will give a zero bid. A mean WTP of SEK 110 and a median WTP of

50 were obtained if the zero bids were included. If the zero bids instead were excluded, mean WTP was estimated at SEK 185 and median WTP at SEK 100.

- **Inregia AB, Institutet för regional analys (1993), ”Bromma flygfält: Vad tycker brommaborna och andra stockholmare?” Report, Inregia AB, Stockholm.**

Reference number: I1

The contingent valuation method was applied to measure the willingness to pay for relocating the commercial flights from Bromma airport. A mail questionnaire was sent to a sample on 1000 households, 500 in Stockholm and 500 in Bromma. A discrete choice WTP-question with a bid vector containing five bids (SEK 250, 500, 1000, 2000, 3000) was used. The payment vehicle was a yearly contribution for three years. The mean WTP for the whole sample was SEK 0. Those respondents who stated they had a positive willingness to pay were also asked if they would (A) certainly pay, or (B) maybe would pay. Based on positive WTP-responses the mean WTP for (A) ranged between SEK 1200 and 1500 and if (B) also was included the WTP ranged from 2500 to 3000.

- **Israelsson, Torun (2001), “Valuing Natural Heritage – An Empirical Application of a Choice Experiment”, *in Infrastructure Investments and Environmental Preservation – An economic foundation for public decisions*. Report 122, Department of Forest Economics, Swedish University of Agricultural Sciences (SLU), Umeå.**

Reference number: I5

The choice experiment method was applied to a land-use conflict between a road construction project and the preservation of a Natural Heritage area in the south of Sweden. The study area was the road (E65) between Malmö and Ystad, where the reconstruction of the road between Börringe and Svedala would affect the Natural Heritage area called “Backlandskapet söder om Romeleåsen”. The sample was selected from three regions in Sweden: the County of Västerbottten in the north of Sweden, the Counties of Södermanland and Västmanland in the middle of Sweden and the County of Skåne in the south of Sweden. The telephone directory of each region was used to pick a random sample of in total 329 individuals. A mail questionnaire was distributed to the sample in April 2000. Each respondent had to answer 3 sets with 3 alternatives, containing 7 attributes. One status quo alternative was included in each set. The attributes used, with levels within parenthesis, were: biology, landscape and recreation (improvement, status quo, deterioration), noise (0,4,6 houses disturbed from noise), safety (24, 28, 30 number of injured individuals/year), tax (SEK 0, 50, 400), time (-30, 0, 70 hours gained for all vehicles during 24 hours). The influence on the CE result of the following variables was tested: gender, age, univer-

sity education, population, children at home, retired, student, low income <30,000 SEK, large environmental interest, prefer railroads, adequate level of infrastructure and distance to the project Skåne or Västerbotten. The implicit prices of the attributes, which represent the household's WTP, were calculated. The WTP of each attribute represents a once-for-all payment. The mean willingness to pay turned out to be SEK 312 for biology, SEK 124 for recreation, SEK 180 for landscape, SEK 76 for safety, SEK 0.09 for time and SEK –28 for noise. These welfare measures were used in an analysis of three actual road alternatives for the planned road construction of the road E65. The estimated values originating form encroachments in the natural area were incorporated in a cost- benefit analysis of the road alternatives.

- **Ivehammar, Pernilla (1996), "Värdering av biltunnel framför resecentrum i Linköping med binär CVM". VTI notat 18, The Swedish National Road and Transport Research Institute (VTI), Linköping.**

Reference number: I2

The purpose of this contingent valuation study was to estimate the willingness to pay among households in Linköping for replacing the road in front of the travel center with a car tunnel. A mail questionnaire was sent to a random sample of 502 residents in Linköping in the age between 20 and 75 years. The final response rate was 73.5%. A discrete choice WTP-question, containing 16 bids that ranged from SEK 10 to SEK 1200, was used. The payment vehicle was an increase in the municipality tax for 20 years. The mean annual WTP turned out to be SEK 202 per individual.

- **Ivehammar, Pernilla (1998) "Problem vid värdering av miljöförändringar av investeringar i transportinfrastruktur. Fallstudie om Centralbron i Stockholm i tunnel utförd med binär CVM". VTI notat 16-1998, The Swedish National Road and Transport Research Institute (VTI), Linköping.**

Reference number: I4

The willingness to pay for replacing Centralbron and the railroad bridge (between Gamla Stan and Södermalm) in Stockholm with a tunnel was estimated with the use of the contingent valuation method. The purpose of the study was to examine the impact of the valuation question on the estimated measure of willingness to pay. In 1997, a mail questionnaire was sent to a random sample of 3600 inhabitants in Stockholm. The response rate was 69%. A number of eight different questionnaires were used. The main questionnaire was sent to 800 respondents and the seven alternative questionnaires were sent to 400 respondents each. In order to analyse how the provided information affects the estimated willingness to pay, the information in each alternative questionnaire

was changed in one respect compared to the main questionnaire. A discrete choice WTP-question was used. In the main questionnaire, the respondents were asked about their willingness to pay for replacing both Centralbron and the railroad bridge with a tunnel. The payment vehicle used in the main alternative was an increase in municipality tax for 10 years. A non-parametric method was used to calculate the willingness to pay. The mean annual WTP amounted to SEK 697 per person. The willingness to pay for replacing only Centralbron with a tunnel, not the railroad bridge, was estimated in one of the alternative questionnaires. The estimated mean annual WTP turned out to be SEK 538 per individual. A mean annual WTP was also estimated based on the data derived from the remaining six questionnaires, where less/more information was provided, another payment vehicle or a longer time period was used. Based on the data from the main questionnaire the total willingness to pay was estimated at 6.7 billion SEK.

- **Ivehammar, Pernilla (2001), ”Värdering av miljöförändring i tid respektive pengar – exemplet Ugglumsleden i Partille”. VTI notat 25-2001, The Swedish National Road and Transport Research Institute (VTI), Linköping.**

Reference number: I3

Two different questionnaires were used in this contingent valuation study with the objective of estimating the value of an environmental change in both money and time. The case study was a road in Partille community, Ugglumsleden. A random sample of individuals between 18 and 75 years living in Partille was in 2000 sent a questionnaire. The first questionnaire was distributed to 750 individuals and the response rate achieved was 71%. The respondents had to choose between two options, keeping the road and the present traffic situation or an enlargement of the road through a forest area. The latter alternative might save some time for the individual, depending on her travel pattern but would instead lead to a physical encroachment in a green area. The mean willingness to pay in terms of increase travel time was estimated at about 25 minutes per week or 22 hours per year for preserving the green area.

In the second questionnaire the respondents were asked about their willingness to pay for replacing the existing road with a tunnel. This questionnaire was sent to 1045 individuals and a response rate of 64% was achieved. A discrete choice question with a bid vector containing seven bids between SEK 0 to 5000 was used (SEK 0, 20, 100, 500, 1000, 2000, 5000). The payment vehicle used was an increase in the community tax for ten years. The following model was estimated:

$$P = \frac{e^{(0.4707 - 0.0005\,bid + 0.000021\,income + 0.116*visits - 0.0177*age)}}{1 + e^{(0.4707 - 0.0005\,bid + 0.000021\,income + 0.116*visits - 0.0177*age)}}$$

Where P is the probability that the respondent prefers to put the road in a tunnel, bid is the bid expressed in SEK, income represents the household income, visits is the number of visits in the recreational area per month and age is expressed in years. The estimated mean WTP was approximately SEK 1000.

- **Jernelöv, Arne (1992), ”Miljöskulden. En rapport om hur miljöskulden utvecklas om vi ingenting gör”. SOU 1992:58. Ministry of the Environment (Miljö- och naturresursdepartementet), Stockholm.**

Reference number: J1

The Swedish “environmental debt is estimated in this study. The environmental debt is defined as the cost of restoring the environmental damage that can technically and economically be restored. The size of the environmental debt in 1990 and the change of the debt during the year were calculated for the following areas:

a) Climate: debt SEK 85000 million, increase SEK 2500 million.
b) Acidification: debt SEK 47000 million, increase SEK800 million.
c) Cadmium in agricultural land: debt SEK 6000 million, increase SEK 100 million.
d) Loss of humus: debt SEK 25000 million, increase SEK 1300 million.
e) Eutrophication: debt SEK 10200 million, increase SEK 0.
f) Persistent organic pollutants: debt SEK 200 million, increase SEK 0.
g) Waste: debt SEK 83000 million, increase 1900 million SEK.
h) Biodiversity: debt SEK 4600 million, increase 0.

The total environmental debt amounted to SEK 261,000 million and the increase during 1990 amounted to SEK 6600 million.

- **Johansson, Per-Olov (1989), “Valuing public goods in a risky world: An experiment”. p. 37-48 In Henk Folmer and Ekko van Ierland (eds.), *Valuation Methods and Policy Making in Environmental Economics*. Studies in Environmental Science 36, Elsevier Science Publishers, Amsterdam.**

Reference number: J8

The contingent valuation method was applied to estimate the economic value of preserving endangered species living in Swedish forests. A mail questionnaire was sent to a random sample of 200 Swedes. The response rate was 61%. The respondents were asked about their willingness to pay, in an open-ended question, for four different programmes that would save some or all of the 300 endangered species in the Swedish forest. Contributions, as one-time payments, to programmes that would save some or all endangered species was used as payment vehicle. Three different programmes were presented: (A) save 100%, (B)

save 75% and (C) save 50% of the endangered species. The mean WTP was estimated at SEK 1275 for (A), SEK 775 for (B) and SEK 555 for (C).

- **Johansson, Per-Olov (1990), "Willingness to pay measures and expectations: an experiment". *Applied Economics*, 22, 313-329.**

Reference number: J13

The contingent valuation method was applied to estimate the value of moose hunting in Västerbotten, in northern Sweden. The objective of the study was to examine if and how the willingness to pay for a hunting permit is affected by the hunter's expectations concerning the outcome of the hunt. A mail questionnaire was sent to a sample of 200 hunters in the county of Västerbotten who had bought a hunting licence. The response rate was 75%. However, the analysis of data was restricted to the 110 hunters who expect to hunt moose during the next hunting season. The hunter was asked to state his maximum willingness to pay for a hunting permit. He was also asked to estimate the probability that he himself would kill at least one moose and alt least two moose, respectively. The following model was estimated:

$$WTP_{next} = \beta_0 + \beta_1 \bar{q}_1 + \beta_2 p\bar{q}_2 + \beta_3 \sigma_1^2 + \beta_4 \sigma_2^2 + \beta_5 z + \varepsilon$$

where the dependent variable is the willingness to pay for the next hunting season. The variable $\bar{q}_1$ represents the number of moose the hunter expects to kill and $p\bar{q}_2$ is the expected value of the moose meat. The variance of the $\bar{q}_1$-variable is represented by σ_1^2, the variance of the $p\bar{q}_2$-variable is represented by σ_2^2 and *z* is a recreational dummy variable, which takes on the value 1 if moose hunting provides recreational experience the hunter cannot find elsewhere and 0 if not. The coefficients to be estimated are β_i with i=0,…,5 and ε is a stochastic error term. The mean willingness to pay for the forthcoming hunting season turned out to be SEK 2700 per hunter, in 1986 prices.

- **Johansson, Per-Olov and Bengt Krisrtöm (1988), "Measuring values for improved air quality from discrete response data: two experiments". *Journal of Agricultural Economics*, 39, 439-455.**

Reference number: J5

The value of an elimination of sulphur emissions in Sweden was estimated with the use of the contingent valuation method. Two different measures were derived: a usual WTP-measure and the willingness to offer jobs in the industry tin order to secure an improvement in air quality. A mail questionnaire was distributed to a random sample of 700 Swedes. The response rate was 67%. The respondents were asked about their willingness to pay for a programme, which would eliminate the discharge of sulphur. A discrete choice WTP-question with a bid vector containing five bids ($15, $80, $160, $320, $640) was presented to half the sample (A). The other half of the sample (B) was asked to evaluate the

programme in terms of jobs lost, specified as 500, 1000, 2000, 10000 or 20000 jobs lost. In (A) a mean annual WTP of SEK 4500 per person was obtained. The average willingness to pay in terms of jobs lost turned out to be 150 000 jobs.

- **Johansson, Per-Olov, Bengt Kriström and Leif Mattsson (1988), "How is the Willingness to Pay for Moose Hunting Affected by the Stock of Moose? An Empirical Study of Moose-hunters in the County of Västerbotten". *Journal of Environmental Management*, 26, 163-171.**

Reference number: J11

Based on a contingent valuation study the benefits of different sizes of moose stock were estimated. A number of 80 hunters in the county of Västerbotten were asked about their willingness to pay for the opportunity to hunt moose (Compare with reference number M3). A mail questionnaire was used. A 50% reduction in the stock of moose from its current level would decrease the annual WTP by SEK 640 per person. A 100% increase from current level would instead lead to an increase in the annual WTP of SEK 760 per person.

- **Johansson, Per-Olov and Stojan Zavisic (1989), "Svenska folkets miljöbudget". *Ekonomisk Debatt*, 17, 6, 472-474.**

Reference number: J7

In this contingent valuation study, Swedish households were asked about their willingness to pay for environmental action programmes. The mail questionnaire was sent to 500 randomly chosen households in Sweden. The response rate was 46.4%. An open-ended WTP-question was used. The respondents were told that the payment would be proportional to the personal income. An annual mean WTP of SEK 1200 per household was obtained and the median WTP was estimated at SEK 400 per household and year.

- **Katz, Katarina and Thomas Sterner (1990), "The Value of Clean Air: Consumers' Willingness to Pay for a Reduction in Gasoline Vapours at Filling Stations". Energy Studies Review, 2, 39-47.**

Reference number: K2

The willingness to pay for gasoline vapour recovery systems was estimated with the use of the contingent valuation method. A mail questionnaire was distributed to 800 respondents. A number of 600 of these were a random sample of residents in Gothenburg, aged 18 and upward. The other 200 respondents were customers of a local gasoline company, Prajs, whose stations were equipped with vapour recovery systems. This group had knowledge about the system and constituted therefore a control group. The mean WTP was 15.7 öre per litre of

gasoline. If the average WTP was weighted by the amount of gasoline annually purchased a WTP of an extra 11.9 öre per litre of gasoline was obtained. Telephone interviews were conducted with non-respondents and when their answers were included the mean WTP for the whole sample was estimated at 9.4 öre per litre. Two alternative linear regression models of WTP were estimated with the following independent variables included: gender, age, income, annual driving distance, experience of recovery systems, children, dependent on having a car, holds account with a gasoline company, choice of station dependent on price, considers that only the companies ought to pay, given less information in the questionnaire, Prajs customer, considers motoring a serious problem and disapproves of restrictions on motoring.

- **Kihlman, Tor, Sören Wibe and Siv M. Johansson (1993), "Priset på tystnad: En enkätstudie om människors värdering av bullerdämpande åtgärder", Appendix 7 to *Handlingsplan mot buller.* SOU 1993:65. Ministry of the Evironment (Miljö- och naturresursdepartementet), Stockholm.**

Reference number: K9

The contingent valuation method was applied to estimate an economic value of a reduction of traffic noise. A mail questionnaire was sent to 750 households in eight selected areas in Stockholm and Gothenburg. The areas were divided into three different types (I, II, III) according to the level of noise, where the lowest noise level is found in I and the highest in area III. The response rate was 42%. The respondents were asked about their willingness to pay for a reduction of traffic noise. A discrete choice WTP-question, with a bid vector containing three bids (SEK25, 50 100) was used. Two different valuation questions were included in the questionnaire: (A) WTP for soundproof windows and (B) WTP for a reduction of traffic noise to get completely quiet surroundings. In addition the respondents were asked about their willingness to pay for soundproof widows, in terms of a decreased living area. In area I, the mean willingness to pay turned out to be SEK 56 per household and month for soundproof windows and SEK 112.5 to get completely quiet surroundings. In area II, the mean monthly WTP amounted to SEK 100 per household for (A) and SEK 250 for (B). In area III, the mean WTP was estimated at SEK 100 per household and month for (A) and SEK180 per household and month for (B). The question about WTP, in terms of decreased living area, for soundproof windows resulted in WTP estimates per flat of 3.2 m^2 in area I, 3 m^2 in area II and 4 m^2 in area III. A valuation study of interior noise level is also included in the report.

- **Kriström, Bengt (1990), "Valuing Environmental Benefits Using the Contingent Valuation Method – An Econometric Analysis". Doctoral thesis, Umeå Economic Studies No 219, Umeå University.**

Reference number: K3

This contingent valuation study concerns the value of preserving a set of forests in Sweden. In 1987 a questionnaire was sent to a random sample of 1100 individuals. The sample was dived into two sub-samples, where (A) contained 900 individuals that received both a discrete choice and an open-ended valuation question and sample (B) of 200 individuals received only the open-ended question. The response rate was 67%. The respondents were asked about their willingness to pay to preserve eleven fragile forests in Sweden (Muddas, Tärna-Graddis, Skule, Dala-Härjedals and Jämlandsfjällen, Hamra, Garphyttan, Tiveden, Norra Kvill, Kullaberg – Hallandsåsen, Åsen – Listerlandet, Dalby-Söderskog). A one-time payment was used as payment vehicle. The open-ended valuation question resulted in a mean WTP of SEK 1023 per household and a median WTP of SEK 200 per household. Based on the discrete choice question a mean WTP of SEK 2500 and a median WTP of SEK 1030 were obtained.

- **Kriström, Bengt (1997), "Spike Models in Contingent Valuation". *American Journal of Agricultural Economics*, 79, 1013-1023.**

Reference number: K6

The contingent valuation method was applied to estimate the economic value of wave damages caused by large passenger ferries in the Stockholm archipelago. A mail questionnaire was sent to a sample of 1000 individuals chosen from those who are living or owning property along the route of the passenger ferries trafficking Sweden-Finland. The valuation question was formed as a referendum and the respondents were asked if they would accept to pay a certain amount to move the route of the ferries. The contribution should be made for 5 years. A mean willingness to pay of SEK 1500 was estimated and the median WTP amounted to SEK 0.

- **Laitila Thomas and Anton Paulrud (2002), "Combining Conjoint Analysis and Choice Experiments for Valuation of Fishing Site Characteristics". Arbetsrapport 329, Department of Forest Economics, Swedish University of Agricultural Sciences (SLU), Umeå.**

Reference number: L8

This paper applies a combination of conjoint analysis and choice experiment, a method that is called Multiple Attribute Contingent Valuation Method (MACVM). The study was carried out in 1998 in Jämtland in Sweden. A mail questionnaire was sent to 200 randomly chosen anglers. The sample was selected from a register of buyers of fishing licenses to four different areas. The response rate was 67%. The anglers were first asked a CVM question about their willingness to pay for doubling the catch they experienced during their previous visit to Jämtland. A discrete choice question was used with a bid vector containing five bids (SEK 25, 50, 100, 200, 300). A fee was used as the payment vehicle in the CVM question. In the

MACVM question a hypothetical angling site was described with the use of 8 characteristics. The type of water (river) and the type of fish species (grayling and brown trout) were fixed. The other characteristics, accessibility from car-road, bag-limit, expected catch per day, distance from residence, congestion and fee, were varied on three levels. The respondents were asked if they would choose the described site or another fishing site for their next fishing trip.

The following model was used to analyse the CVM data:

$$P(bidaccepted) = \exp[\alpha_1 z + \beta c]/[1 + \exp[\alpha_1 z + \beta c]]$$

Where *z* is the number of fish caught during the respondent's previous fishing trip in Jämtland and *c* denotes the bid. A mean WTP of SEK 46.61 for an extra fish caught was obtained from the CVM question. A 95% confidence interval gave an interval of SEK 14.64 to 78.58 for the mean WTP.

The model for the analysis of the MACVM data was formulated as:

$$P(A) = \exp(\gamma_0 + \gamma_1 x_1 + ... + \gamma_{11} x_{11})/[1 + \exp(\gamma_0 + \gamma_1 x_1 + ... + \gamma_{11} x_{11})]$$

where

x_1 = dummy for residents in south Sweden
x_2 = number of household members
x_3 = number of river fishing days last year
x_4 = part of total household income
x_5 = accessibility to site form car-road
x_6 = bag-limit
x_7 = catch per day
x_9 = distance to site from residence
x_{10} = congestion
x_{11} = fee per day

The MACVM study resulted in a mean WTP of SEK 15.60 for an extra fish caught. A 95% confidence interval was estimated at SEK -0.30 to SEK 31.50.

- **Landell, Elin and Stefan Smith (1988), ”Miljökostnader av väginvesteringar - en metodstudie”. Master thesis in Economics T7, Linköping University.**

Reference number: L1

The contingent valuation method was applied to estimate the willingness to pay for locating a road in a tunnel. The method was applied in two case studies: (a) the proposed road, Gillbergaleden, in Eskilstuna and (b) the recently constructed road, Söderleden, in Norrköping.

(a) A mail questionnaire was sent to a random sample of 200 households in the affected areas in Eskilstuna. The response rate was 54%. One half of the sample received an open-ended WTP question and the other half received a WTP-question of payment card format. A one-time payment through municipal taxes was used as payment vehicle. The open-ended question resulted in a WTP of SEK 355 and the payment card format question resulted in a WTP of SEK 686 per household.

(b) A mail questionnaire was sent to a random sample of 124 households in and Norrköping. The response rate was 71%. One part of the sample relieved an open-ended WTP-question and the other an open-ended WTA-question. A one-time payment through municipal taxes was used as payment vehicle. The mean WTP amounted to SEK 7536 per household and the median was SEK0. The mean WTA amounted to SEK 35,347 per household and the median was SEK 0.

- **Leksell, Ingemar (1987), ”Samhällsekonomisk värdering av bilavgasutsläpp”. DsK 1987:6, Ministry of infrastructure (Kommunikationsdepartementet), Stockholm.**

Reference number: L3

This valuation of air pollution was based on political willingness to pay, i.e. political decisions about emission standards and charges. The marginal cost of decreasing health effects, corrosion and soiling from air pollution in urban areas was estimated at SEK 15-25 SEK/kg NO_x, 600 SEK/kg particles and 2200 SEK/kg lead. The marginal cost of reducing forest damage due to air pollution amounted to 15 SEK/kg NO_x.

- **Leksell, Ingemar and Lars Löfgren (1995), ”Värdering av lokala luftföroreningseffekter - hur värdera bilavgasernas hälsoeffekter i tätorter?” Report 1995:5, The Swedish Transport & Communications Research Board (KFB), Stockholm.**

Reference number: L4

Monetary values of regional and global environmental damage and local health effects of exhaust emissions in urban areas were estimated in this study. The valuation of damage to the natural environment due to exhaust emissions was based on Swedish environmental charges and standards. This resulted in values of 1 SEK/kg CO_2, 40-45 SEK/kg NO_x, and 20 SEK/kg VOC (volatile organic compounds). The valuation of health effects was based on secondary data derived from contingent valuation studies.

- **Leksell, Ingemar (1999) ”Ekonomisk värdering av luftföroreningar från trafiken”. Department of Applied Environmental Science, Göteborg University. A report to SIKA (Swedish Institute for Transport and Communication Analysis).**

Reference number: L10

The objective of this report is to estimate an economic value of local and regional effects of the emissions of NO_x, SO_2 and VOC (volatile organic compounds) expressed in SEK per kg emission. The value of the regional effects was based on marginal costs of achieving environmental quality objectives and the value of local health effects was based on secondary data. The value of regional environmental effects of exhaust emissions was estimated at 60 SEK/kg for NO_x, 20 SEK/kg for SO_2 and 30 SEK/kg for VOC.

- **Li, Chuan-Zhoung and Peter Fredman (1994), “On Reconciliation of the Discrete Choice and Open-Ended Responses in Contingent Valuation Experiments”, In Chuan-Zhoung Li (1994), *Welfare Evaluations in Contingent Valuation – An Econometric Analysis*. Doctoral thesis. Umeå Economics Studies No. 341, Umeå University.**

Reference number: L5 (See also reference number F1)

The benefits of the white-backed woodpecker in Sweden were estimated in a contingent valuation survey. In 1993, a mail questionnaire was sent to a random sample of 3360 Swedish citizens, aged between 17 and 74 years. A number of 2880 individuals received questionnaires with a discrete choice WTP-question and 480 received an open-ended WTP-question. Only the results derived from the open ended data is considered here, for the result from the DC-question see reference number F1. The response rate was 45%. A mean WTP of SEK 7,651 was estimated and the median WTP was SEK 494. A regression analysis of WTP was estimated with the following explanatory variables: age, sex, income, education, residence, attitude, nature, motive, information and level.

- **Lindberg, Kreg, Tommy D. Andersson and Benedict G. C. Dellaert (2001), “Tourism Development – Assessing Social Gains and Losses”. *Annals of Tourism Research*, 28, 1010-1030.**

Reference number: L14

Choice modelling was applied to estimate how an increase in ski slopes affects the welfare of tourists and residents in Åre, a winter tourism community in Sweden. Data was collected as a part of larger host and guest surveys conducted in 1999 in the Åre region. The survey was sent to residents, 18 years or older, in the study area and to tourists visiting the study area. The study area was defined

by postcodes. A systematic sample of 905 individuals was selected from the study population using a randomly chosen starting point. The response rate of the residential survey was 61%. Names and addresses for the visitor survey were collected during three separate periods. A random sample of slopes was selected and interviewers were positioned close to the lift. Skiers that appeared to be at least 15 years old was asked to participate in the survey. A negligible number of people refused to participate. The questionnaire was sent to 994 individuals and the response rate was 78%.

Each respondent in the visitor survey answered four choice sets containing two alternatives, of which one represented the current situation. Two attributes were used to describe the alternatives: number of new slopes (four levels ranging from 5 to 100) and price increase for lift tickets (four levels ranging from SEK 10 to 100). The presented scenarios in the resident survey contained the two attributes: number of new slopes (ranging from 5 to 50) and amount of annual change in tax (reduction or increase ranging from SEK 250 to 10,000). The respondents in favour of more slopes were directed to a question involving an increase in tax and those opposed were directed to a question involving a tax reduction.

The following independent variables were included in the resident benefits model: Number of slopes, tax, income, dependence of household income on tourism, general statement for/against tourists, preferences for change in the number of tourists in the future, and number of ski days. The presented welfare values are averages across all individuals in the relevant sample, i.e. 3000 adult residents in the study area. The benefit of 10 new slopes per “for” resident was estimated at SEK 2,250 or in total SEK 2.565 million. For 5, 25 or 50 new slopes the estimated benefit was SEK 299 per “for” resident or SEK 0.299 million in total. The cost per “against” resident was estimated at SEK 5,418 for 5 new slopes, SEK 17,084 for 10 new slopes, SEK 30,902 for 25 new slopes and SEK 32,831 for 50 new slopes. Total costs of 5, 10, 25, 50 slopes were 10.077, 31.776, 57.477 and 61.066 millions respectively. The focus for the economic value accruing to tourists was on welfare change to Swedish society as a whole. The gain to tourists was estimated at SEK 11 for 5 new slopes, SEK 33 for 25 new slopes and SEK 31 for 50 new slopes. The resulting total annual benefits for nonlocal Swedish skiers were 6.283, 18.850 and 17.707 million SEK for 5, 25 and 50 new slopes, respectively. The WTP per day was SEK 8 for residents and SEK 11 for visitors, in the case of 5 new slopes.

- **Lindberg, Kreg, Jon Martin Denstadli, Peter Fredman, Tobias Heldt and Tuomas Vuorio (2001), ”Skiers and snowmobilers in södra Jämtlandsfjällen: Are there recreation conflicts?” Working paper 2001:12, The European Tourism Research Institute, ETOUR, Östersund.**

Reference number: L9

This survey contained a contingent valuation part and a choice modelling part. The survey was addressed to both residents and visitors. Separate surveys were used for skier visitors and snowmobile visitors. Visitors were contacted on-site in Södra Jämtlandsfjällen to collect addresses for a longer mail survey. In the residential survey mail questionnaire was sent to every adult in Vålådalen, Storsjö Kapell and Ljungdalen and to every third adult in Undersåker. The questionnaire was sent to a number of 230 snowmobile visitors, 505 skier visitors and 444 residents. The response rates of the mail questionnaires were 63% for snowmobile visitors, 75% for skier visitors and 66% for residents. Both skier and snowmobile visitors were targeted by the contingent valuation question. However, few snowmobile visitors answered that they wanted separate trails and therefore the result for that group was not analysed in the study. The contingent valuation question was a discrete choice question about the respondent's willingness to pay for trail separation. A probit regression model was estimated with the probability of a yes answer as the dependent variable. The independent variables were: the cost of dagkort (the daily fee), days spent in the study area within the past three years and reported disturbance by snowmobiles. The estimated mean daily WTP for the total sample with protests included was SEK 33. The estimated daily WTP was also presented for two sub-samples. The WTP for Ljungdalen/Vålådalen was SEK 119 and for Storulvån SEK 66, protests were excluded.

The choice modelling study was addressed to the skiers. Two trails were described in terms of distance from residence (0, 3, 10, 25 km), the cost of using the trail (SEK 0, 20, 50, 75), the presence of shelters (No, many), the quality of the scenery (average, nicer than average), and the degree of interaction with snowmobiles (shared track, hear but no see or smell, no see hear or smell but allowed in the area, not allowed in the area). The presented scenario did not in particular focus on the study region. The respondent was asked to choose the preferred trail, but could also select "don't go skiing" if she did not prefer any of the described trails. Each respondent answered four choice sets. The welfare gain is calculated as the WTP per day resulting from a change in snowmobile presence. The obtained daily WTP for going from "shared track" to "hear, but no see or smell" was SEK 53 and from "hear, but no see or smell" to "no see, hear or smell, but allowed in the area" SEK 6.2. Going from "no see, hear or smell, but allowed in the area" to "not allowed in the area" resulted in a WTP of SEK 8.8 and the going from "shared track" to "not allowed in the area" resulted in the largest welfare gain with a daily WTP of SEK 68.

- **Lindqvist Dillén, Johanna, Jonas Eliasson, Jenny Widell and Isak Jarlebring (2003), "Värdering av intrångseffekter". Transek, Solna.**

Reference number: L15

The value of encroachments due to roads and railways, in form of for example noise, visual impression and road safety, was estimated in this study. A stated preference method (conjoint) was applied. The study was carried out in the Stockholm area, in the municipalities Sollentuna, Huddinge, Stockholm and Upplands Väsby, and in Västerås. Respondents who recently (<5 years ago) had bought a house close (about < 1 km) to a road or a railway were selected for the survey. A number of 1349 questionnaires were sent to respondents in Stockholm and 807 in Västerås. The respondents were first contacted by telephone and questionnaires were sent to those who accepted to participate. In addition 101 persons in Stockholm accepted to take part in a personal interview. The response rate of the Stockholm and Västerås mail surveys was 49% and 46%, respectively. A response rate of 30% was achieved in the interview survey. The respondents were asked to choose which of two described houses they would have bought, given the conditions of their actual house purchase. An option of not buying was also included, giving the respondent in total three alternatives. The following three attributes were used: distance to road/railway (50-1400 m), barrier against road/railway (wire fence, noise barrier made of wood, noise barrier mad of glass, bank), monthly housing costs (80-135 % of real cost). In the mail survey, the presented road was a motorway or a road with a speed limit of 70 km/h and in the personal interviews a road with a speed limit of 70 km/h or 50 km/h was presented. To analyse the willingness to pay a reference case was identified. In the reference case the distance to the road was 600 metres and the willingness to pay for the reference house was SEK 7000. The mean willingness to pay for a house that is located 200 meters from the road/railway ranged between SEK 3049 and SEK 4048 per household and month, depending on the type of road. The WTP was also calculated for a segment of tolerant individuals. This resulted in higher estimates and the WTP ranged from SEK 5464 to SEK 6174. The willingness to pay for a house with some kind of noise barrier against the road was approximately 10-15 percent higher compared to a house without noise barrier.

- **Lindvall, Jan (2001), ”Betalningsvilja för Göta Kanal”. Forskning från Linköpings universitet; 4. Linköping University Electronic Press. (www.ep.liu.se/ea/gotakanal/2001/004/)**

Reference number: L6

The contingent valuation method was applied to estimate the value of the Swedish canal, Göta Kanal. Personal interviews were conducted with visitors of the canal in the summer of 1999 at the following locations: Söderköping, Berg, Borensberg, Karlsborg, Forsvik, Hajstorp and Sjötorp. In addition a questionnaire was distributed to tourists travelling by boat on the canal. The questionnaire was given to the tourists in the beginning of the tour and was handed in at the last lock they passed. A number of 1002 interviews were conducted and 166 questionnaires were gathered. The visitors of the canal were divided into the

groups: tourists (using other means of transportation than bicycle), local population and cycling tourists. The tourists were asked about their willingness to pay for a visit of the canal. Follow up discrete choice questions were used. The first bid was SEK 10 and the bid was raised to SEK 20 and then SEK 30 if the respondent accepted the bids. If also the highest bid of SEK 30 was accepted the respondent was asked to state her willingness to pay in an open-ended question. The mean WTP obtained for the tourists was SEK 11.80. The local population was instead asked about their willingness to pay an annual fee to visit the canal. An open-ended question was used and the resulting mean WTP was SEK 60.67. The cycling tourists were asked about their willingness to pay a fee for cycling along the canal (cykelpass). The question was asked as an open-ended question and the resulting mean WTP was SEK 79.73. For the tourists and the local population no payment vehicle was presented.

The tourists travelling by boat answered questions about if they still would be willing to pay if the fee for passing through the locks was raised by 10% or by 20%. They were also asked to report how much they actually had paid in fees. The result was interpreted as the WTP per boat. The majority of this group was Swedish tourists and the estimated WTP for that group is presented here. However, some foreigner tourists also answered the questionnaire, which was available both in English and German. Swedish tourist travelling by boat had a mean WTP of SEK 2200.94 if the fee was increased by 10% and a mean WTP of 2277.52 if the fee was increased by 20%.

- **Löfgren, Tora and Mattias Hjerpe (2001), ”Ekonomisk värdering av Göta Kanal med Contingent Valuation Method”. Master Thesis in Economics. Forskning från Linköpings universitet; 3. Linköping University Electronic Press. (www.ep.liu.se/ea/gotakanal/2001/003/)**

Reference number: L7

The contingent valuation method was applied to estimate the total economic value of Göta Kanal. In 1999 a mail questionnaire with a discrete choice WTP question was sent to a sample of 3000 individuals. The sample was divided into two different sub-samples: a random choice of 1500 individuals in Sweden and 1500 individuals living close to Göta Kanal, where 750 individuals were randomly chosen from the nearby municipalities and 750 individual were randomly chosen from the postcodes in the area. The sample was also restricted to individuals in the age group of 18-70 years. The response rate was 53.2% in the first sub-sample and 64.8 in the second sub-sample. The respondents were asked if they were willing to pay a given amount for preserving the canal in its present state. Five bid vectors were used (SEK 10, 20, 50, 100 or 500). The payment vehicle was an annual payment for 10 years. A mean WTP of SEK 100-225 and a median WTP of SEK 0 was obtained for individuals in the first sub-sample. For sub-sample 2 the mean WTP was SEK 175-290 and the median WTP was SEK 57. WTP was modelled as a function of: sex, age, children in

the household, level of education, environmental interest, number of canal visits and planned future canal visits.

- **Löwgren, Marianne (2001), ”Emåns nyttjande och hävd – En undersökning av marknadsvärden”. VASTRA report 2, Tema Vatten, Linköping University.**

Reference number. L13

This is a study of monetary values for water-related goods and services within a catchment area, Emån River Basin. Both use values and non-use values were estimated. Different methods were used for valuation of the identified water-related goods. The methods include for example, market prices, extraction cost, avoidance cost and cost of restoration. The calculations were based on a time perspective to the year 2020 and the discount rates of 5% or 8%. The value of hydropower is estimated based on market prices times the quantity, resulting in a value of SEK 28.5 million. The value of drinking water was estimated at SEK 62 million, based on the average water consumption times the price per m^3 (including a share of the fixed cost) in the municipalities in the study area. The value of water used in agricultural production was calculated in a similar way, resulting in an annual value of SEK 4 million. A value of approximately SEK 40 million was estimated for the value of recreational fisheries and fish farms in the study area. This estimate was based on the average price per kg fish (different species) multiplied by the estimated quantity of caught fish, the revenue form the three fish farms in the area and the revenue from the selling of fishing licenses. The value of sewage treatment was estimated in the same way as the value of drinking water, price per m^3 times the average quantity. A value of SEK 12 millions was obtained. Restoration cost for polluted areas was also calculated based on a number of projects in the study area, resulting in an estimate ranging from SEK 12 to 15. In addition the cost of liming was also estimated at SEK 2 million. From this result, a total annual value of SEK 230-240 million was obtained.

- **Malmberg, Johan (1994), ”Attityder till bekämpningsmedel och betalningsviljan för en minskad användning av dess i det svenska jordbruket”. Master thesis 126, Natural Resource and Environmental Economics, Department of Economics, Swedish University of Agricultural Sciences, Uppsala.**

Reference number: M1

The willingness to pay for reduction of biocides in the Swedish agriculture was estimated with the use of the contingent valuation method. In 1994, a mail questionnaire was distributed to 380 random chosen households in Sweden and the respondents were in the age between 16 and 74 years. The response rate was 46%. An open-ended format of the WTP-question was used. The respondents

were asked about their WTP for (1) a complete cessation in the use of biocides and (2) a 50% reduction relative to the current level of biocides used. An increase in prices on food was used as payment vehicle. A mean annual WTP of SEK 2760 per household was obtained for a complete cessation in the use of biocides. The corresponding median value was SEK 100. The annual willingness to pay for a 50% reduction in the use of biocides was SEK 1800 per household and the median WTP was SEK 100. The aggregate WTP for all households in Sweden was 9500 million SEK per year for (1) and 6400 million SEK per year for (2). A regression model of WTP was also estimated. The explanatory variables included were: number of household members, household income, place of residence, and attitudes towards the use of biocides.

- **Mattsson, Leif (1990), "Hunting in Sweden: Extent, Economic Values and Structural Problems".** ***Scandinavian Journal of Forest Research*****, 5, 563-573.**

Reference number: M2

The contingent valuation method was applied to estimate the economic value of moose hunting and hunting for other game, with a geographical division into Southern Sweden (Svealand and Götaland) and Northern Sweden (Norrland). In June 1987, a mail questionnaire was sent to a random sample of 2500 hunters in Sweden. The response rate was 67%. A payment card format of the WTP-question, with 26 alternatives ranging from SEK 0-199 to SEK 18 000-20 000, was used. The maximum increase of seasonal hunting costs before deciding not to hunt was used as payment vehicle. For moose hunting, the estimated annual mean WTP was SEK 3750 per hunter Southern Sweden and SEK 3550 per hunter in Northern Sweden. The corresponding figures for other game hunting were SEK 2480 for hunters in Southern Sweden and SEK 2060 for hunters in Northern Sweden. The total gross hunting value in Sweden was 1439 million SEK and the total hunting costs was estimated to 608 million SEK. As a result the total consumer surplus amounted to 831 million SEK. In addition the total hunting value was divided into "meat value" and "recreation value".

- **Mattsson, Leif and Bengt Kriström (1987), "The Economic Value of the Moose as a Hunting Object".** ***Scandinavian Journal of Forest Economics*****, 29, 27-37.**

Reference number: M3

The contingent valuation method was applied to estimate the value of moose hunting, including both meat and recreational values, in the county of Västerbotten in the northern part of Sweden. In June 1986, a mail questionnaire was sent to a sample of 400 hunters. The response rate was 68%. The respondents were asked about their willingness to pay for keeping the possibility of hunting moose given that the hunt result does not change. An open-ended WTP-

question was used. An annual payment was used as payment vehicle. The annual mean WTP of moose hunting was estimated at SEK 3358 per person or SEK 2931 per person, depending on how the WTP-question was formulated. The annual mean WTA amounted to SEK 7401 per hunter. The total consumer surplus of moose hunting in Sweden was estimated to approximately 29 million SEK. The following explanatory variables were tested in the regression analysis of WTP/WTA: quantity of meat, number of moose killed by the hunter himself, number of moose hunting days, number of days spent for hunting other game, number of years being a moose hunter, actual moose hunting costs, members within the household and income.

- **Mattsson, Leif and Chuan-Zhong Li (1993), "The Non-Timber Value of Northern Swedish Forests". *Scandinavian Journal of Forest Research*, 8, 426-434.**

Reference number: M4

A contingent valuation survey was undertaken in order to assess the non-timber value of forests in the county of Västerbotten in northern Sweden. In 1991, a mail questionnaire was sent to a random sample of 2000 individuals, aged between 17 and 74 years, in the county of Västerbotten. The response rate was 62.3%. An open-ended as well as a discrete choice willingness to pay question was used. For the DC-question a bid vector containing ten bids was used (SEK 50, 100, 200, 400, 700, 1000, 2000, 4000, 8000 and 16000). An annual payment for the visit was used as payment vehicle. Based on the data derived from the OE-question, the annual mean WTP amounted to SEK 2234 per individual. The corresponding mean value based on the data from the DC-question turned out to be SEK 5856. The estimated non- timber value was also divided into the components: on-site consumptive use value (berry- and mushroom picking), on-site non-consumptive use value (hiking, camping, etc.) and off-site visual experience value. The total non-timber value was estimated at 1050 million SEK per year.

- **Mattsson, Leif and Chuan-Zhong Li (1994), "How do Different Forest Management Practices Affect the Non-Timber Value of Forests? An Economic Analysis". *Journal of Environmental Management*, 41, 79-88.**

Reference number: M5

The contingent valuation method was applied to estimate the non-timber value of forests in the county of Västerbotten in northern Sweden. A number of 800 random chosen individuals in the county of Västerbotten were sent a mail questionnaire in 1992. The response rate was 54.5%. The respondents were asked about their willingness to pay for using/experiencing the non-timber commodities as previously both in an open-ended and in a discrete choice WTP-question.

An annual payment was used as payment vehicle. A mean annual WTP of SEK 2195 per individual was estimated based on the data derived from the open-ended WTP-question. The corresponding discrete value estimate amounted to SEK 3386 per individual. The respondents were also asked about their preferences regarding different forest attributes. Four photo series of forest landscapes were presented in the questionnaire. Each landscape corresponded to a particular silvicultural system. Based on this data a non-timber value function was developed:

$$\ln(y) = -13 \cdot 5884 + 1 \cdot 1641 \times \gamma_x + 2 \cdot 9971 \times \ln(1 + z_1) + 1 \cdot 9516 \times \ln(1 + z_2)$$
$$+ 1 \cdot 4637 \times \ln(1 + z_3) + 0 \cdot 8364 \times \ln(1 + z_4)$$

where x = 1,2,3,4 which represents the four different forest landscapes presented to the respondents and z_i=1,2,3,4, represents the shares of the tree species pine, spruce, birch and other broadleaves.

- **Nilsson, Måns and Monica Gullberg (1998), "Externalities of Energy: Swedish Implementation of ExternE Methodology: The contingent valuation study on Klippen". Stockholm Environment Institute (SEI).**

Reference number: N1

The study includes an application of the contingent valuation method. The objective was to estimate an economic value of the external cost of the Klippen plant. Klippen is located in the Storuman municipality in the northern part of Sweden and Klippen hydro power station is located in the upper part of Ume Älv. The study was of ex ante type and therefore a site with similar characteristics to Klippen was identified. The site used was Vojmån, about 200 km south of Klippen. Three target groups were identified: local population of Vojmån, tourist in the area and the average Swede. For the groups of locals and Swedes a random sample in the age between 17-84 years was sent a questionnaire. Both groups had a sample size of 600 individuals respectively. The response rate for locals was 50% and for Swedes 54%. For the group tourists, 235 interviews were conducted around Vojmån. The respondents answered a WTP question of discrete choice type with a bid vector containing five different bids (SEK 100, 500, 1500, 3000, 6000). For the tourist group the amounts SEK 250, 1000 and 2000 were also used. The payment vehicle used was an annual contribution to a fund to cover the costs of keeping Vojmån in its current condition. The respondents were told that all Swedes would contribute with the same share of their income. The estimated average WTP for respondents who claimed that they absolutely would pay was SEK 300 for Swedes, SEK 600 for locals and SEK 500 for tourists. If also those who claim they maybe would pay were included in the analysis, average WTP was SEK 700 for Swedes SEK 1900 for locals and SEK 2000 for tourists.

- **Olsson, Christina (1993), ”Linbanan i Norsjö - en skogsinriktad turist-attraktion. En undersökning av besökarnas betalningsvilja för att uppleva skog och natur”. Master thesis in Economics, Umeå Economic Studies No 325, University of Umeå.**

Reference number: O1

A contingent valuation study was carried out in 1993 to estimate the value visitors of the ropeway in Norsjö derive from forest recreation. A number of 212 questionnaires were distributed to Swedish visitors at the ropeway during the period June 10 to June 12, 1993. In addition, but not summarized here, the questionnaire was also distributed to foreigner visitors. The response rate was 97.2%. The open-ended format of valuation question was used. The respondents were asked to state their willingness to pay for a trip journey similar to the one they were out on. The respondents were also asked how much of the value of the trip they were making was attributable to the visit at the ropeway. The respondents' value of the visit at the ropeway was used as an approximation of the value of forest recreation. A one-time payment was used as payment vehicle. The mean WTP amounted to SEK 2068 and the median to SEK 900.

- **Paulrud, Anton (2000), ”Ekonomisk analys av sportfiskarnas val av fiskeplats – en pilotstudie gällande för öring- och harrfiske i rinnande vatten”. Arbetsrapport 290, Department of Forest Economics, Swedish University of Agricultural Sciences (SLU), Umeå.**

Reference number: P2

A stated preference method was applied in this study. The objective was to study anglers' choice of angling site. The study is a pilot study and covers only parts of the data gathered in the survey. The study was restricted to Swedish anglers older than 15 years that had been angling in Jämtland in 1998 and paid for their fishing trip themselves. Addresses were gathered from anglers that, during 1998, bought fishing license for the fishing management units Storsjö fvo, Lidsjöbergs fvo, Nerdre Ammeråns fvo and Linsell-Ransjö fvo. Choice-based sampling was applied. A mail questionnaire was used, which was sent to 200 anglers. The response rate was 67%. A hypothetical fishing site was described to the respondent with the use of the following eight attributes: type of water, species, accessibility, restrictions of catch, expected catch, distance from residence, number of anglers at the site and license fee. The respondent was asked if he/she would choose the described fishing site or another site for the next fishing trip.
The following model was estimated:

$$V(X_i, Z_{ij}) = \alpha_0 + \sum_{k=1}^{3} \alpha_k X_{ik} + \sum_{j=1}^{6} \beta_j z_{ij}$$

where

X_1 = the respondent's part of household income
X_2 = number of household members
X_3 = dummy, 1 if the respondent lives in the south of Sweden
Z_1 = distance from road
Z_2 = restriction of catch
Z_3 = catch per day
Z_4 = distance from residence
Z_5 = number of anglers at the site
Z_6 = fishing license

The marginal willingness to pay for an extra fish caught was estimated at approximately SEK 16. An increase of the distance from the fishing site to the closest road increased the marginal willingness to pay with SEK 0.13 per meter. If the distance between the respondent's residence and the fishing site increased with 10 km the corresponding decrease in WTP was approximately SEK 8.

- **Paulrud, Anton (2001), "Sportfisket i Bohuslän – samhällsekonomiska aspekter". Arbetsrapport 300, Department of Forest Economics, Swedish University of Agricultural Sciences (SLU), Umeå.**

Reference number: P1

This study is an application of the travel cost method. A mail questionnaire was used to collect data. The questionnaire was sent to three different groups of Swedish anglers: anglers in river and lakes in the studied fishing management units, coast anglers and guide-boat anglers. For anglers in the fishing management units the addresses were gathered when they bought fishing licenses, addressed to the coast anglers were gathered at the fishing sites and the staff at the guide-boats gathered addresses to anglers joining their tours. More than 2000 questionnaires were sent and the response rate was over 70%. The following model was estimated:

$$LnV_{ij} = \beta_0 + \beta_1 C_{ij}$$

where:

i = fishing site
j = zone
Vij = fishing day frequency
Cij = cost per fishing day

The cost per fishing day was based on the distance travelled times a cost of SEK 15 per 10 km and the alternative cost of time as one third of the income per household member. The consumer surplus per fishing day was estimated for the different types of fishing and it ranged between SEK 53 and SEK 127. The

total consumer surplus for the fishing sites included in the study amounted to 18 million SEK per year. The marginal consumer surplus was also estimated for the different types of fishing. The marginal consumer surplus of an extra fish caught ranged between SEK 18-33 for the fishing management units. The estimated marginal consumer surplus for an extra fish caught along the coast was SEK 5 and for the guide-boats SEK 10. The marginal consumer surplus of an extra kilo fish was estimated at SEK 11 for the coast and SEK 18 for the guide-boats and ranged between SEK 29-43 for the fishing management units.

- **Paulrud, Anton (2003), "Marginal Valuation of Improving The Catch for Sport-fishers". Arbetsrapport 333, Department of Forest Economics, Swedish University of Agricultural Sciences (SLU), Umeå.**

Reference number: P5

The contingent valuation method is applied to estimate the economic value of catch by sport-fishers, focusing on the marginal values of fish caught. The survey was carried out in 1998 and it was addressed to Swedish anglers in the county of Bohus in Sweden. The questionnaire was mailed to more than 2000 anglers who had visited the study area in 1998. The response rate was 70%. The respondents were asked about their willingness to pay for a doubling of the catch compared to the catch the respondents experienced during their fishing trip. A discrete choice question was used with a bid vector containing five bids (SEK 25, 50, 100, 200 and 300). The payment vehicle used was an extra fee. The anglers were divided into five different groups according to the type of angling; ordinary, put and take, river, coast and guide-boat angling. The WTP for doubling the catch was estimated for each type of angling and the estimates ranged between SEK 24 and SEK 160 for doubling the number of fish and SEK 26 to SEK 98 for a doubling of kilo fish. The marginal WTP for catching an extra fish was between SEK 5 and SEK 531, depending on the type of angling and the marginal WTP for an extra kilo of fish ranged between SEK 11 and SEK 172.

- **Paulrud, Anton (2003), "Recreational Values of Different Types of Sport-Fishing in Western Sweden". Arbetsrapport 334, Department of Forest Economics, Swedish University of Agricultural Sciences (SLU), Umeå.**

Reference number: P6

The Zonal Travel Cost method was applied to estimate the recreational values of angling and catch. The survey was carried out in 1998 and it was addressed to Swedish anglers, over 15 years old, in the county of Bohus in Sweden. The anglers were divided into five different groups according to the type of angling; ordinary, put and take, river, coast and guide-boat angling. For the first three types of angling addresses to the anglers were collected from 10 out of 32 fish-

ing management units that sold licenses. For coast anglers the addresses were collected on site and the staff at the guide-boats collected addresses from the participants on their tours. The questionnaire was sent to more than 2000 anglers who had visited the study area in 1998. The response rate was 70%. The consumer surplus per angling day was calculated for each type of angling. For ordinary angling the consumer surplus was SEK 53, for the put and take angling SEK 83, for river fishing SEK 127, for coast fishing SEK 56 and for guide-boat fishing SEK 115. The marginal consumer surplus was also estimated for the different fishing management units, the coast and the guide-boats. The marginal value for catching an extra fish ranged between SEK 18-35 for the fishing management units and was estimated at SEK 5 for the coast and SEK 10 for the guide-boats. The marginal consumer surplus for an extra kilo ranged between SEK 11 and SEK 43, depending on the type of angling. For estimates of MCS on an extra fish and MCS of an extra kilo of fish 95% confidence intervals were also provided. The consumer surplus per fish and per kilo of fish was also estimated in the study.

- **Paulrud, Anton and Dalin, Per-Eric (2001), ”Sportfisket i Kaitum – en rapport om sportfiskarna, sportfisket och dess samhällsekonomiska värde”. Arbetsrapport 305, Department of Forest Economics, Swedish University of Agricultural Sciences (SLU), Umeå.**

Reference number: P3

The travel cost method was applied to estimate the consumer surplus of a fishing day in the river Kaitumälven. A mail questionnaire was used to collect data. The questionnaire was sent to 106 Swedish anglers and the response rate was 72%. The addresses were gathered when interviews with anglers were conducted in the project called the Ecologically Managed Angling Tourism on the Kaitum River. The following model was estimated:

$$LnV_{ij} = \beta_0 + \beta_1 C_{ij}$$

where:

i = fishing site
j = zone
Vij = fishing day frequency
Cij = cost per fishing day

The alternative cost of time was included in the estimates of travel cost as one third of the wage rate. The consumer surplus was estimated at SEK 166 per fishing day.

- **Paulrud, Anton and Thomas Laitila (2003), "Valuation of Management Policies for Sport-Fishing on Sweden's Kaitum River". Arbetsrapport 335, Department of Forest Economics, Swedish University of Agricultural Sciences (SLU), Umeå.**

Reference number: P4

This study estimated the economic value of the attributes of the Kaitum River in northern Sweden. An angling utility function was estimated based on data generated from an application of the choice experiment method. A mail questionnaire was sent to Swedish anglers that had visited the Kaitum River in the summer of 2000, 2001 or 2002. The questionnaire was mailed in three separate surveys in 2001 and 2002. The addresses were gathered by address-collectors walking along the river in the summer of 2000 (64), 2001 (105) and 2002 (37), the sample size within parenthesis. The scenario described was a four-day trip to Kaitum River at a cost of SEK 3000. Two hypothetical fishing sites at the Kaitum River were described for the respondent, who was asked to choose one of them for his/her next trip to the river. The following nine attributes were used to describe the fishing sites: catch per day of Grayling < 30 cm, 30-40 cm and > 40 cm, catch per day of Brown Trout < 30 cm, 30-40 cm and > 40 cm, bag-limit per day of Grayling and of Brown Trout and extra fee per day. The estimated willingness to pay for catching an extra small fish per day was SEK 17, a medium sized fish was SEK 109, and a large fish was SEK 333. The WTP for the option of bringing home an extra fish per day was estimated at SEK 44. Confidence intervals (95%) were also presented for the WTP estimates. The estimated utility function was also used for valuation of four potential management scenarios. The valuation of the scenarios "over-fished", "natural restriction", and "natural" was done relative to the scenario "catch and release", which is close to the actual situation. Compared to the "catch and release" scenario "naturally restricted will decrease the mean WTP with SEK 656 for one day angling. The scenario "over-fished" will decrease the mean WTP with SEK 1114 and the "natural" scenario will increase the mean WTP with SEK 1322.

- **Sandstöm, Mikael (1996), "Recreational benefits from improved water quality: A random utility model of Swedish seaside recreation". Working Paper No 121, Working Paper Series in Economics and Finance, Stockholm School of Economics.**

Reference number: S1

A random utility maximization (RUM) model of Swedish seaside recreation was used to estimate the benefits form reduced eutrophication of the seas around Sweden. In the study, data on travel behaviour from the Tourism and Travel database (TDB) was used. The TDB is based on information collected through monthly telephone interviews with a random sample of Swedish households. The data used was restricted to non-business travel to coastal areas in the summer month of June, July and August for the years 1990 through 1994.

The total sample includes 3169 trips. The function of the indirect utility from visiting a site was assumed to have the following form:

$$V_j = \beta_1 TTC_j + \beta_2 Lnsight_j + \beta_3 Bech_j + \beta_4 Licence_j + \beta_5 Sun_j$$

A cost function, based on the stated total trip cost, was used to calculate the travel cost, TTCj. The cost of time for travelling was also included. The variable, Lnsight, is the natural logarithm of sight depth at the site. The variable Beach represents the number of beaches in the municipality, Licence the number of alcohol-serving licenses per thousand inhabitants in the municipality and SUN denotes the average hours of sunshine per month. To policy simulations were carried out using the nested multinomial logit (NMNL) and conditional logit (CL) specifications. The first policy experiment regards a 50% reduction of the nutrient load to the Laholm Bay in southwest Sweden. The consumer surplus based on the NMNL model amounted to 12 million SEK and 32 million SEK based on the CL model. The other policy experiment regards a uniform change of the nutrient load along the entire Swedish coast. The consumer surplus from a 50% reduction of the nutrient load was estimated to be around 240 million SEK in the NMNL model and 540 million SEK in the CL model.

- **Schéele, Siv and Riitta Sorsa (1996), ”Stockholmarnas syn på Bromma flygplats 1996 jämfört med 1993”. Inregia AB, Institutet för regional analys, Stockholm.**

Reference number: S9

This study is a follow up of a study carried out in 1993 (Reference I1). The objective of this study was to examine the Stockholm residents’ view on Bromma airport. A mail questionnaire was used. The questionnaire was mailed to 1000 random chosen households in Stockholm, 500 in Bromma and 500 in Stockholm, in 1996. The response rate was 67%. The survey contained a contingent valuation question of discrete choice type. The respondents were asked about their household’s willingness to pay for a total shutdown of Bromma airport. A bid vector containing five bids (SEK 100, 250, 500, 1000, 3000) was used in the WTP-question. A yearly contribution to a fund for three years was used as payment vehicle. In total 10 % of the respondents stated a positive willingness to pay. The respondents were also asked if they certainly would pay or maybe would pay the given amount. The obtained mean WTP for the respondents who certainly would pay was SEK 900. If respondents who maybe would pay the presented bid were included the mean WTP increased to SEK 1600.

- **Silvander, Ulf (1991), ”Betalningsvillighetsstudier för sportfiske och grundvatten i Sverige”. Dissertations 2, Department of Economics, Swedish University of Agricultural Sciences, Uppsala.**

Reference number: S2

This study concerns environmental problems caused by nitrogen leakage to water. The study is divided into two parts: (a) angling (b) groundwater.

(a) A contingent valuation survey was undertaken in order to estimate the value of angling in Sweden. A questionnaire was sent to a number of 1000 randomly chosen inhabitants in Sweden in the age of 16-74 years. The respondents were in, an open-ended question, asked to state their willingness to pay for a project that would guarantee the survival of a number of fish species. The response rate was 65.3%. An annual payment in form of a tax was used as payment vehicle. A mean WTP of SEK 232 per person and year was obtained, which corresponds to a value of SEK 25 per angling day. The total value amounted to 1449 million SEK per year. A regression model of WTP was also estimated. The following explanatory variables were tested: age, income, capital, sex, owner of fishing-waters, number of fishing days per year, number of household members, number of household members who angle in Swedish salt and brackish water, number of household members who angle in Swedish fresh water, household income and level of education.

(b) The willingness to pay for a project that would guarantee that the nitrate concentrations in all ground water would be below the WHO-limit of 50 mg/l was estimated with the use of the contingent valuation method. In 1989, a mail questionnaire was sent to a random sample of 1000 inhabitants in Sweden, aged between 16 and 74 years. An open-ended format of WTP-question was used. The respondents stated their willingness to pay for a project that would keep the nitrate concentrations in ground water below the WHO-limit of 50mg/l. An annual payment in form of a tax was used as payment vehicle. A mean annual WTP of SEK 326 per individual was obtained and the total value amounted to 1449 million SEK per year. A regression model of WTP was also estimated. The following explanatory variables were tested: age, income, capital, sex, number of household members, level of education and children under the age of 1 years old.

- **Silvander, Ulf and Lars Drake (1991), ”Nitrate Pollution and Fisheries Protection in Sweden”, In Nick Hanley (ed.),** ***Farming and the Countryside: An Economic Analysis of External Costs and Benefits*****. CAB International, Oxon, England.**

Reference number: S20

This study concerns nitrate pollution and the effects of eutrophication in the Baltic Sea, Kattegat and Skagerarak. Economic losses in the domestic fish catching industry, in aquaculture and in the fish processing industry were estimated. The total economic loss of a continued leaching of nitrate to the Baltic, Kattegat and Skagerrak amounted to SEK 318 million for the commercial fishing. The study also reports the value of the welfare loss for angling and groundwater, based on data from a contingent valuation study (see reference S2).

- **Soutukorva, Åsa (2001), "The value of improved water quality – A random utility model of recreation in the Stockholm archipelago". Beijer Discussion Papers Series No. 135, The Beijer International Institute of Ecological Economics, The Royal Swedish Academy of Sciences, Stockholm.**

Reference number: S11

Recreational values from a reduction of the nutrient concentrations in the Stockholm archipelago was estimated in this study by application of the travel cost method. The data used was gathered in surveys carried out in 1998 and 1999. A mail questionnaire was used in both surveys. In 1998 the questionnaire was sent to 4000 randomly selected inhabitants of the counties Stockholm and Uppsala. The response rate was 47.2%. In 1999 a number of 2500 individuals received the questionnaire and the response rate was 60%. The consumer surplus of a hypothetical 1-metre improvement of mean sight depth was calculated. Four conditional logit models were estimated for the probability that a site is visited. The independent variables include was: travel cost, travel cost including time valuation, mean sight depth and communication by ferry. The models differed in the treatment of time. Two of the models attached a value to travel time equal to 30 % of the wage rate, where in the other two the value of travel time was ignored. The aggregated consumer surplus of the two counties Stockholm and Uppsala was estimated for the years 1998 and 1999. When time was not valued the aggregated consumer surplus was 59 million SEK in 1998 and 70 million SEK in 1999. The corresponding estimates when a value of time was included in the model were 93 million SEK in 1998 and 110 million SEK in 1999. Due to poor weather in the summer of 1998 the estimated for that year was in the study interpreted as the lower bound of CS. The estimates for 1999 was in the same manner interpreted as upper bound estimates due to extraordinary beautiful weather.

- **Sundberg, Sara (2003), "Att värdera miljön genom ersättningskostnader – en granskning av metoden och tillämpning på havsöringshabi-**

tat". Master Thesis in economics 306, Department of Economics, Swedish University of Agricultural Sciences (SLU), Uppsala.

Reference number: S21

The replacement cost method was applied to value Sea trout habitats in a watercourse, Kagghamraån, south of Stockholm. The cost of putting gravel on the bottom of the stream as a restoration measure was estimated. The cost amounted to about 305,000 SEK, as a one-time payment in 1995 prices, for a result of 68-260 smolts (young Sea trout) returning to the sea per year.

- **Sundqvist, Thomas (2002), "Quantifying household preferences over the environmental impacts of hydropower in Sweden: A choice experiment approach", In *Power Generation Choice in the Presence of Environmental Externalities*. Doctoral thesis, 2002:26, Department of Business Administration and Social Sciences, Luleå University of Technology.**

Reference number: S16

This paper uses the choice experiment method to estimate how Swedish house-owning households value different environmental impacts arising from hydroelectric production. A mail questionnaire was sent to a random sample of 1000 Swedish house-owning households in 2002. The number of choice sets presented to the respondents was 30 and these were randomly divided into five groups so that each respondent had to answer six choice sets. Each choice set consisted of two alternatives, where one represented the status quo option. The following four attributes were used to describe the alternatives: downstream water level (status quo, +25%, +50%), erosion and vegetation (status quo, -25%, -50%), fish life (status quo, mitigating measures adapted to migratory species or all species) and price change per kWh (6 levels ranging from 0 öre to 25 öre). The final response rate was 40%. The result was obtained by estimating a random effects binary probit model. Included in the model were the attributes described above and also some socio-economic and attitudinal variables: whether the respondent regularly buys environmental goods ("green products"), regularly fish for recreation, prefer government provision of green electricity, chose alternative which gave the most value for the money, could not afford to pay more for green electricity, would rather spend money to make other power sources more environmentally benign, weighted all attributes against each other, gender, monthly household income, children, education and electricity heated house. The implicit prices, which are the marginal rate of substitution between one of the attributes and the monetary attribute, were calculated. A positive implicit price is interpreted as the marginal willingness to pay. Statistical significance could be established for the implicit prices of erosion and vegetation (-50%) and fish (all). The respondents are willing to pay 1.48 for erosion impacts to be lowered by 50% or 1.67 öre per kWh extra for all fish species to

be preserved. For the calculated implicit prices, 95% confidence intervals were also presented in the paper.

- **Sundqvist, Thomas (2002), "Quantifying non-residential preferences over the environmental impacts of hydropower in Sweden: A choice experiment approach", In *Power Generation Choice in the Presence of Environmental Externalities*. Doctoral thesis, 2002:26, Luleå University of Technology.**

Reference number: S17

The choice experiment method is applied to estimate Swedish non-residential electricity consumers' value of environmental impacts arising form hydroelectric production. In 2002 a mail questionnaire was sent to 845 randomly selected small- and medium-sized firms in Sweden. The number of choice sets presented to the respondents was 30 and these were randomly divided into five groups so that each respondent had to answer six choice sets. Each choice set consisted of two alternatives, where one represented the status quo option. The following four attributes were used to describe the alternatives: downstream water level (status quo, +25%, +50%), erosion and vegetation (status quo, -25%, -50%), fish life (status quo, mitigating measures adapted to migratory species or all species) and price change per kWh (6 levels ranging from 0 öre to 25 öre). The final response rate was 29%. A random effects binary model was estimated. The attributes from the choice experiment were included in the model as well as some attitudinal and firm-specific variables. The following additional variables were used: environmental impact of hydropower, the firm's environmental concern, interest in buying green electricity, green image, prefer government provision of green electricity, public sector and electricity cost share. The implicit prices were calculated and statistical significance was established for erosion and vegetation (-50%) and fish (all). The obtained willingness to pay for all fish species to be preserved was 1.76 öre per kWh and for erosion impacts to be lowered by 50% the WTP was 1.41 öre per kWh.

- **Svedsäter, Henrik (1996)," Willingness to Pay for an Environmentally Protective Engine - a Contingent Valuation Study". Master Thesis 1996:4, Unit for Environmental Economics, Department of Economics, Gothenburg University.**

Reference number: S15

The objective was to estimate the willingness to pay for an environmentally protective engine among potential future car buyers. Further the objective was to estimate the Swedish public's willingness to contribute to a public subsidy of environmentally protective engines. A mail questionnaire was used to collect data and it was sent to 1224 households. Both open-ended and discrete choice

WTP-questions were used. The sample was divided into 624 respondents of "potential future car buyers" and 600 respondents of "the public". A response rate of 49.2% was achieved in the sample of potential car buyers and 32.2% in the sample of the public. An extra payment at the time of the hypothetical car purchase and an increase in the income tax was used as a payment vehicle for the two sub-samples respectively. The main analysis was based on an estimation of a linear regression model:

$$WTP = C + \alpha_1 D_1 + \alpha_2 D_2 + \ldots + \alpha_n D_n + \ldots + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n$$

The independent variables could be grouped into attitudes of respondents, personal and household characteristics, ability to pay and car practices. For the sub-sample of potential car buyers a mean WTP of SEK 6,856 was obtained. The median was SEK 5,000. The mean WTP in order to subsidise the environmental protective engines amounted to SEK 916 per year and the median was estimated to SEK 500.

- **Söderqvist, Tore (1987), "Miljöavgifter och pantsystem för kvicksilverhaltiga batterier". Master thesis in economics, Stockholm School of Economics.**

Reference number: S13

The damage cost of methyl mercury (MeHg) in fish in Sweden was estimated in this study. This was calculated with the use of two alternative methods, the human capital method and estimates based on political willingness to pay. Applying the human capital method, the cost of health care and the value of production lost due to mental retardation caused by mercury were estimated. The total cost amounted to 2.46-27.06 million SEK per year. The damage cost was also estimated based on political decisions about emission standards. The case of ScanDust AB in Landskrona was examined. The firm has to invest in abatement technology to be able to meet the emission standards for mercury. An abatement cost of SEK 78,600 per kg Hg was calculated for ScanDust AB's emissions. The total cost for emissions of Hg in Sweden amounted to SEK 432.3 million in 1984. A CBA of a deposit system for collection and recycling of batteries was also conducted in the study.

- **Söderqvist, Tore (1995), "Estimating the Benefits of Health Risk Reduction: The Contingent Valuation Method Applied to the Case of Residential Radon Radiation". Beijer Discussion Paper Series No 57, The Beijer International Institute of Ecological Economics, The Royal Swedish Academy of Sciences, Stockholm.**

Reference number: S5

The contingent valuation method was applied to estimate the benefits of a reduction of residential radon radiation. In 1991, a mail questionnaire was sent to a random sample of 500 households living in single-family houses in Sollentuna. The questionnaire contained two discrete choice valuation questions, one about a reduction of the radon concentration from 500 to 70 Bq/m^3 and one about a reduction from 500 to 200 Bq/m^3. A bid vector with ten bids ranging from SEK 100 to SEK 100,000 was used in 50% of the questionnaire. The remaining 50% of the respondents were given a bid vector with ten bids ranging from SEK 2000 to SEK 1,000,000. A one-time payment was used as payment vehicle. The response rate was 55%. The willingness to pay turned out to be SEK 87,000 per household for a reduction form 500 to 70 Bq/m^3 and SEK 35,000 per household for a reduction from 500 to 200 Bq/m^3.

- **Söderqvist, Tore (1995), "Property Values and Health Risks: The Willingness To Pay for Reducing Residential Radon Radiation". *Scandinavian Housing and Planning Research*, 12, 141-153.**

Reference number: S4

A hedonic price model was employed to estimate households' maximum willingness to pay for a reduction of the radon concentration in the County of Stockholm. The study was based on data of market prices and 19 characteristics of (a) all single-family houses with radon concentrations above 400 Bq/m^3 sold in the study area during the period 1981-1987 and (b) a random sample of 1800 non-contaminated single-family houses sold during the same period. The following WTP function was estimated:

$$\Delta p_m = \alpha_0 + \alpha_1(y_m - p_m) + \eta_m$$

where m represents different geographical areas, Δp the difference between a contaminated house and a non-contaminated house α_0 and α_1 are coefficients that are estimated. The present value of the mean lifetime income of households living in single-family houses is denoted by *y* and the market price of the representative house *p*. The house price was calculated by inserting the characteristics, *z*, of a representative house in the estimated hedonic price function $p_k = \beta_0 + \sum \beta_i z i_k + \varepsilon_k$. The following characteristics, *z*, were included: standard of house, age of house, living area, lot size, local tax rate, travel time by car to Stockholm city, time trend for date of house sale, dummy variables for: chain houses, terrace houses, basement, furnished attic, basement and furnished attic, special conditions likely to increase market price, special conditions likely to decrease market price, high radon daughter concentration, lots with special conditions likely to increase the market price, lots with special conditions likely to decrease the market price and built before 1910. The last term in the above expression, η_m, is a stochastic error term. A mean WTP of SEK 21,300 per household was obtained. The WTP estimate expresses a representative house-

hold's maximum willingness to pay for a reduction of radon concentration from at least 400 Bq/m^3 to a concentration below that level.

- **Söderqvist, Tore (1996), "Contingent Valuation of a Less Eutrophicated Baltic Sea". Beijer Discussion Paper Series No. 88, The Beijer International Institute of Ecological Economics, The Royal Swedish Academy of Sciences, Stockholm.**

Reference number: S8

The contingent valuation method was applied to estimate the benefits from a reduced eutrophication of the Baltic Sea. In 1995, a mail questionnaire was sent to a random sample of 696 Swedes in the age between 18 and 85 years. The response rate was 60.4%. A discrete choice as well as an open-ended WTP-question was included in the questionnaire. The discrete choice WTP-question contained a bid vector with seven bids (kSEK 1, 2, 4, 6, 10, 15 and 25). The valuation question was formed as a referendum and the respondent was asked if she would vote for or against an international action plan against the eutrophication. Mean willingness to pay estimates were obtained by, logit, probit and non-parametric analyses. The respondents were divided into non-protesters, weak protesters and strong protesters. An average of the derived WTP-estimates was calculated. This resulted in a mean annual WTP for non-protesters of kSEK 7 per person and for non-protesters and weak protesters the mean annual WTP was slightly lower than kSEK 6.5 per person. The total national willingness to pay amounted to 21,816 million SEK, based on the assumption of zero WTP for all other groups than non-protesters.

- **Söderqvist, Tore (2000), "Natural Resources Damage from Chernobyl: Further Results". *Environmental and Resource Economics*, 16, 343-346.**

Reference number: S12

The value of some components of natural recourses damage from the Chernobyl nuclear accident in 1986 was estimated. The primary focus of this study was on the loss in producer surplus in the reindeer industry in Lappland, in northern Sweden. The estimate of the loss of producer surplus was based on the compensation paid by the government to compensate for contaminated reindeers that had to be slaughtered and the extra cost due to the accident, such as costs of test for cesium concentration. This compensation amounted to MSEK 567 during the period 1 July 1986-30 June 1994. Based on the fact that reindeers will be found contaminated also after this period, the net compensation for the period 1 July 1994-30 June 2008 was also calculated to SEK 18 million. In addition compensations of about SEK 1 million have also been paid to fishermen. A total value of four components of natural recourse damage from the Chernobyl

accident was estimated at SEK 736 million expressed in 1995 prices. The damage suffered by Swedish moose hunters, which was derived from an earlier study, was also included in this total value. The damage per adult Swede was also computed at SEK 112.

- **Söderqvist, Tore and Henrik Scharin (2000), "The regional willingness to pay for reduced eutrophication in the Stockholm archipelago". Beijer Discussion Papers Series No. 128, The Beijer International Institute of Ecological Economics, The Royal Swedish Academy of Sciences, Stockholm.**

Reference number: S14

The contingent valuation method is applied to estimate the benefits of a reduced eutrophication in the Stockholm archipelago. A mail survey was sent to a random sample of 4000 inhabitants, in the age of 18-75 years, in the counties of Stockholm and Uppsala. The response rate was 47.2%. The respondents were asked about their willingness to pay for an abatement programme that in 10 years would result in a 1-metre increase of the sight depth in the inner and central parts of the archipelago. The respondents were first asked in a close-ended question if their WTP>0 or not and for those who had a positive WTP the question was followed by an open-ended WTP question. The payment vehicle chosen was higher prices of tap water and agricultural products. A mean monthly WTP of SEK 71 per person was obtained, when the identified protest answers were excluded from the analysis. The corresponding median WTP was SEK 50. The regional (Stockholm and Uppsala) WTP amounted to about SEK 500-850 million per year, depending on the interpretation of the WTP of the respondents that had answered that they probably would pay. Three linear regression models with WTP as dependent variable were estimated. The following explanatory variables were included: residence in the archipelago, cottage in the archipelago, boat owner, visitor to the archipelago in the summer of 1998, importance of good water quality in the archipelago, female, age and monthly household net income.

- **Toivonen, A-L., Appelblad, H., Bengtsson, B., Geertz-Hansen, P., Gudbergsson, G., Kristofersson, D. Kyrkjebo, H., Navrud, S., Roth, E., Tuunainen, P. and Weissglas, G. (2000), "Economic value of recreational fisheries in the Nordic countries". TemaNord 2000:604. Nordic Council of Ministers, Köpenhamn.**

Reference number: T2

A Contingent valuation questionnaire was used to estimate the willingness to pay for recreational fisheries and the preservation of fish stocks. The same survey was conducted in all Nordic countries, but only the Swedish survey is summarized here.

The sample in Sweden was 7500 randomly selected individuals in the age between 18-69 years. The sample was stratified geographically in accordance with the Swedish population. A mail questionnaire was distributed in 1999. Response rate was 46.69 %. The respondents were asked about their maximum willingness to pay, over and above their actual expenditures, for the same fishing experience. The question was of open-ended type. The resulting mean WTP per fisherman was SEK 548. In addition three different hypothetical fishing sites were described and the respondents were asked to state their WTP in multiple bounded discrete questions. Each question contained ten bids ranging from SEK 100 to SEK 20,000. The respondent was asked to indicate if she/he certainly would pay, almost certainly would pay, was not sure, almost certainly not would pay or certainly not would pay. There was also a question about the maximum amount the respondent almost certainly would pay. An annual rent that would grant the respondent access to the fishing site was used as a payment vehicle. The following fishing sites were described in the scenarios: a stream with a natural stock of salmon and sea trout, a lake that has a natural stock of pike, perch and pike-perch and a lake that has a natural stock of grayling, brown trout and arctic char. The respondents were asked to think about a fishing site near their home, which had been closed for many years, but now would be available for a restricted number of anglers. The obtained mean WTP for the stream with salmon and sea trout, based on the discrete choice question, was SEK 742/SEK 514 depending on the model used for calculation. The corresponding mean WTP for a lake with perch, pike and pike-perch was SEK 511/SEK 408 and for a lake with grayling, brown trout and arctic char SEK 730/SEK 509. The open-ended question resulted in mean WTP of SEK 639, SEK 457 and SEK 634, respectively. A final valuation question aimed ay establishing the economic value for both fishermen and respondents who did not fish. The same type of question was uses as in the three scenarios. An increase in income tax was the used payment vehicle. An annual willingness to pay for preserving the current natural fish stocks and current quality of recreational fisheries was estimated at SEK 614/SEK 358 based on the discrete choice question. The open-ended question resulted in a WTP of SEK 510. The total economic value of recreational fisheries was calculated in two different was giving a result of SEK 2430 / 2500 million.

- **Transek AB (2001), ”Trafiksystemens intrång i boendemiljöer - Värdering av god miljö i pengar”. Transek AB, Solna.**

Reference number: T3

Three different methods for valuation of encroachment effects are examined in this study. The following methods are examined: the stated preference method, hedonic price method and a study of restoration costs.

(a) The hedonic price method was applied to estimate the value of encroachment in the local environment caused by roads and railways. Data on sales prices for houses in the county of Stockholm during the period 1994-1997

was colleted. A number of 39,507 sales prices were included in the data set. Implicit prices were calculated relative to the average house in the sample. The estimated implicit prices were interpreted as the willingness to pay. Houses that are located less than 50 meters from a road with a speed limit of at least 70km/h had a sales price that was 240,000 SEK lower than the average house. The corresponding reduction of the sales price for having a railway closer than 50 meters was SEK 27,900.

(b) A stated preference method was also applied to estimate the value of encroachment in the local environment caused by roads and railways. The study area was the county of Stockholm. The study population was defined as individuals that had bought a house or a summerhouse in Sollentuna or Huddinge municipality during the period 1994-1997. In 2000, a number of 205 interviews were conducted. The sample included both individuals who live close to a road or railway and individuals who are not affected by any encroachment effects. Each respondent answered 29 sets, where each set contained two alternatives. The following six attributes were used to describe the alternatives: type of infrastructure, distance to road/railway, type of area on the other side of the road/railway, type of barrier against the road/railway, possibility to cross the road/railway and house price. Before the interviews, a film was shown to the respondents and they also got to listen to traffic noise. The willingness to pay for noise barriers and possibilities to pass the road/railway was first evaluated separately. Earth berms were highest valued, at SEK 579,716, among the different types of noise barriers. For the possibilities to pass the road/railway, the highest WTP, SEK 330,162, was attached to using a bridge. Noise barriers, passing ways and distance to road/railway were also evaluated simultaneously.

(c) The final study of the value of encroachment in the local environment caused by roads and railways was based on defensive expenditures and political willingness to pay, i.e. decisions about measures against traffic noise. The individuals interviewed in the stated preference study were also asked whether they had been taken measures to reduce encroachment effects from nearby roads or railways. Individuals who live close to a railway spent on average SEK 7400, individuals who live close to a road spent on average SEK 5400 and individual who do not live close to a road or a railway spent on average SEK 1400 on measures to reduce the encroachment effects. Measures taken according to the Swedish Road Association’s action plan to reduce noise pollution was also examined. It is stated in the action plan that measures should be taken to reduce noise if the level exceeds 65 dBA. Investments in noise abatement in Stockholm during the period 1996-1998 were studied. The average defensive expenditure for noise abatement was SEK 78,000 per house and the median was SEK 41,000 per house. In addition, the cost of noise abatement in three controversial cases of road/railway construction in the Stockholm area was studied.

- **Trouvé, Johan and Jan Owen Jansson (1987), ”Värdering av miljökostnader av en ny väg – en fallstudie av planerad motorväg på vägbank over Ljungskileviken”. VTI Notat T07, The Swedish National Road and Transport Research Institute (VTI), Linköping.**

Reference number: T1

The contingent valuation method was applied to estimate the value of the encroachment in the local environment caused by the proposed route of motorway E6 through Ljungskile in the county of Bohuslän. A mail questionnaire was sent to a random sample of 500 households in Ljungskile. Half of the respondents were asked about their willingness to pay for an alternative route of the motorway and the other half about their willingness to accept compensation if the motorway is built nearby as proposed. The final response rate was 66.4%. The mean WTP for an alternative route of the motorway turned out to be SEK 18,000 per individual and the median 5000 per individual. The respondents were also asked about their WTP for status quo, i.e. no new route is built. This question resulted in a mean WTP of SEK 18,000 per individual and a median of SEK 2000 per individual. The mean willingness to accept compensation for the construction of the motorway amounted to SEK 300,000 per individual and the median to SEK 800,000 per individual.

- **Werneman, Peter (1997), ”Vad är det ekonomiska värdet av en kvalitetsförändring i fågelsången? - Contingent Valuation Method som ekonomisk värderingsmetod av vägintrångskostnader”. Report 107, Swedish University of Agricultural Sciences (SLU), Department of Economics, Uppsala.**

Reference number: W1

The contingent valuation method was applied to estimate the encroachment cost of a road project - Arningevägen. The road project would cause a physical encroachment in the green area Fågelsången with recreational and environmental values, located about 20 km north of Stockholm. In 1996 a mail questionnaire was sent to a random sample of 620 individuals, older than 19 years, living in the effected municipalities of Täby and Vallentuna. The respondents were asked about their willingness to pay for the alternative of building the road in a tunnel. An increase of the community tax for 20 years was used as the payment vehicle. Discrete choice questions as well as payment card questions were used. The amounts in the payment card question ranged form SEK 10 to SEK 2000, and an option of stating another amount was also given. A number of 248 individuals were given the WTP question of payment card type and the response rate was 71.8%. The bid vector in the discrete choice question contained four bids (SEK 50, 300, 800, 1800). A number of 372 individuals were given the questionnaire with a discrete choice question and the response rate was 73.9%. A non-parametric method was used to analyse the data from the DC-question. A mean annual WTP of SEK 700 per person was

obtained. The mean WTP was estimated at SEK 270 per person and year based on data derived from the WTP question of PC format.

- **Widlert, Staffan, Gunnar Lind, Esbjörn Lindqvist, Johanna Lindqvist and Ulrika Lindstedt (1993), "Värdering av miljöfaktorer". Transek, Solna.**

Reference number: W5

A stated preference questionnaire was sent to a sample of 2000 individuals in 1993. The sample was selected from the motor vehicle register in the county of Stockholm as well as from the telephone directory of Växjö, Linköping, Sundsvall and Stockholm. The objective was to estimate a value of four different environmental goods: (A) traffic emissions, (B) green areas, (C) encroachment and traffic safety and (4) view from the road. A number of six alternatives were presented for each environmental good. The respondent was asked to rank the alternatives, which were described with 3-4 attributes.

(a) The annual mean willingness to pay for a 50% reduction of emissions injurious to health was estimated at SEK 1750 per individual. A 50% reduction of emissions that cause environmental damage resulted in a mean annual WTP of SEK 1490 and WTP for the corresponding reduction of emissions that cause soiling amounted to SEK 670 per individual.

(b) The willingness to pay (per individual) for having a green area close to the place of residence was estimated for a park (compared to no park), a public recreation area (compared to having 10 km to the closest recreation area) and a watercourse (compared to no watercourse). The mean monthly WTP for a park amounted to SEK 360-530, depending on the size of the park. A mean WTP of SEK 140-510 per month was obtained for the public recreation area, depending on the distance to the area. Depending on the type of watercourse, the mean WTP was estimated to SEK 330-580 per month.

(c) Willingness to pay measures was estimated for: traffic safety (a reduction by half of the risk of traffic accidents compared to unchanged risk), reduction of encroachment effects of the motorway (base alternative: a view over both the lake and the motorway) and view of the city (base alternative: a view over both houses and block of flats). The mean willingness to pay for improved traffic safety amounted to SEK 450 per individual and month. The mean WTP for reductions of the encroachment effects amounted to SEK 810-980 per month. The willingness to pay for the city view ranged between SEK –340-450. The lowest estimate was derived for a view over houses and industries and the highest estimate was derived for a view over houses and fields.

(d) The willingness to pay for another view from a road the respondent drives on every day was estimated. The mean WTP of avoiding noise barriers was estimated at SEK 5.9 per travelled hour. A mean WTP of avoiding driving through a tunnel amounted to SEK 9.50 per travelled hour. The estimate derived for avoiding a bridge was not statistically different from zero.

In addition a "group of experts" was also given the questionnaire.

- **Wilhelmsson, Mats (2000), "The Impact of Traffic Noise on the Value of Single-Family Houses", In *Traffic Noise and Property Values*. Memorandum 5:50, Doctoral thesis, Department of Real Estate and Construction Management, Royal Institute of Technology, Stockholm.**

Reference number: W2

The hedonic price method was applied to estimate the impact traffic noise has on the values of single-family houses. The study area was Ängby, a suburb of Stockholm and the area was limited to a rectangle of 600 by 1000 meters, 300 meters from each side of the road Bergslagsvägen. The study was based on a sample of sale prices for 292 single-family houses, between January 1986 and July 1995 in the study area.

A general hedonic price equation of the following form was used:

$$P = p(\mathbf{Z}_{1i}, \mathbf{Z}_{2j}, \mathbf{Z}_{3k}, \mathbf{Z}_{4l})$$

where

Z_{1i} = structural attributes $i=1,\ldots,n$
Z_{2j} = location attributes $j=1,\ldots,m$
Z_{3k} = environmental attributes $k=1,\ldots,o$
Z_{4l} = macro attributes $l=1,\ldots,p$

Five structural attributes were used in the study: living area, lot size, age, corner lot and a quality measure. The location attributes included were closeness to a park, a dummy variable for South Ängby (SA) area and a set of interaction variables (SA quality, SA living area, SA lot size and SA noise). The model included the following seven environmental attributes: noise level in dBA, visually exposed to road, a combination of the two variables dBA-68 times a dummy for visually exposed to road and four dummy variables for near-by minor road. One macro attribute was used and that was property price index. A mean annual WTP of SEK 8000 per adult was obtained for a non-marginal change.

- **Wilhelmsson, Mats (2000), ”Valuation of Traffic-Noise Abatements”, In *Traffic Noise and Property Values*. Memorandum 5:50, Doctoral thesis, Department of Real Estate and Construction Management, Royal Institute of Technology, Stockholm.**

Reference number: W3

The value of traffic noise abatement was estimated with the use of the repeated-sales method by comparing pre-barrier and post-barrier housing values. A cost-benefit analysis of noise barriers was also conducted. The study area was a suburb northwest of the CBD of Stockholm, where noise barriers were built in 1997 and 1998. A period from 19986 to 1999, that included 129 repeated sales, was studied. The following equation was used to define the value of the house:

$$V_{i,t} = \alpha \cdot P_t + \beta \cdot X_i + \lambda \cdot D_{i,t} + \varepsilon_{i,t}$$

where V is equal to the value of house *i* at time *t* and P is the aggregated house price at time *t*. X represents the housing attributes and D is a dummy variable indicating if the house was sold before or after the noise barrier was built. Living area, lot size and a quality index were the housing attributes included in the model. The distance from the house to the road was also included in the model. Eight different models were used to estimate the benefits of noise barriers.
Total benefits was estimated as in the following equation:

$$W = CS = \sum_{i=1}^{M} \lambda \cdot Vi \cdot \frac{1}{length}$$

where W is the consumer surplus per unit of length of the noise barrier, M is equal to the number of houses in the sample area. The mean value in the sample is used as an approximation for Vi, since not all houses in the sample have been sold during the study period. λ in the equation could be thought of as the horizontal distance between the demand curve pre-barrier and the post-barrier. The estimated total benefit per meter of noise barrier was SEK 25,500, in 1996 price level.

- **Åkerman, Jeanette (1988), ”Economic valuation of risk reduction: the case of in-door radon”. Research Report, The Economic Research Institute, Stockholm School of Economics.**

Reference number: Å2

The objective of this study was to estimate the willingness to pay for the reduction of the risks from radon radiation. Estimates of defensive expenditures, based on market prices of mitigating measures, were used. The Local Health Department in Sollentuna had tested the radon concentration in 2500 homes and collected information about the houses. Homes that had radon concentrations over 400 Bq/m^3 were chosen as the sample. The resulting sample was 317 households. The annual median WTP was estimated at SEK 3120 per household or on average per individual SEK 2.20 per year and reduced Bq/m^3.

Report 5360

The economic value of environmental change in Sweden

- A survey of studies

A significant part of the work carried out by the Swedish Environmental Protection Agency (SEPA) is aimed at providing the Government with analyses and proposals to support their decision making. In order to achieve this, and in accordance with regulation (1995:1322), SEPA is required to carry out Regulatory Impact Assessments (RIAs) of policy and project proposals. The cost effectiveness of such proposals is an important aspect of the RIAs, but there is also an increasing demand for analyses that take into account the environmental benefits that follow from project and policy implementation.

The main objective of *The economic value of environmental change in Sweden, a survey of studies* is to facilitate the use of monetary values of environmental benefits in analytical work and thus support SEPA and other stakeholders' in their undertaking of RIAs.

The study was carried out by Sara Sundberg and Tore Söderqvist at the Beijer International Institute of Ecological Economics on behalf of the Swedish Environmental Protection Agency.

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