Forest Research

Is Forestry Carbon undervalued?

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Is forestry carbon undervalued?

- Overview
  - 1) Background
  - 2) Valuing carbon
    - a) social value
    - b) market value
  - 3) Valuing future carbon savings
    - a) social value
    - b) market value
  - 4) Allowing for non-permanence
    - a) discounting
    - b) other approaches to risk management
  - 5) Concluding remarks & next steps
    - is forestry carbon undervalued?

1) Background:

- Discussion Paper (forthcoming): **Forestry Carbon: Valuation, Discounting and Risk Management**
  - **Aims:**
    - **(i) review of methods (including discounting) used to:**
      - **Value carbon**
      - **Compare carbon benefits in different time periods**
      - **Manage risks and uncertainties**
    - **(ii) consider methodologies that could be used in further extending standards to forestry carbon in UK markets**

Context

- (i) Govt guidance on valuing carbon for policy appraisal
  - currently under review
    - underlying perspectives/assumptions remain controversial
- (ii) DECC Code of best practice for Offset Providers
    - Potential extension to forestry credits more generally?
- (iii) Carbon budgets
  - Dept of Energy & Climate Change Consultation on Carbon Units, the net UK carbon account & carbon accounting
    - Potential extension to forestry credits more generally?
- (iv) Carbon Impact Assessment methodologies linked to the Marginal Abatement Cost (MAC) of Carbon under UK and Scottish Climate Change Bills

Perspectives on Forestry Carbon

(2008 Payments for Ecosystem Services study):

- **Inclusion of forestry in carbon cap-and-trade schemes:**
  - **allows higher emission reduction targets to be reached**
  - **reduces cost of meeting given emissions reduction target**
  - **potentially extremely important (esp. reducing tropical deforestation)**
    - **currently the third largest source of global carbon emissions**
    - **accounting for around a fifth of total emissions**

- **Quality & measurement issues**
  - **Standards & verification** (wide range of quality of carbon credits)
  - **Cost-Effectiveness vs measurement precision**
    - E.g. soil carbon measurement not cost-effective?
  - **Scientific uncertainties**
    - E.g. material substitution benefits generally excluded (range of uses)

DECC Code:

- Govt's Quality Assurance Scheme for Carbon Offsetting
  - launched January 2009
    - replaces draft DEFRA code published in 2008
  - covers:
    - Kyoto-compliant credits
      - CERs (Clean Development Mechnism)
      - ERUs (Joint Implementation)
    - EU Emissions Trading Scheme phase II credits (EUAs)
  - most forestry credits excluded

- Q: How might the Govt's Quality Assurance Scheme be extended to cover forestry credits more generally?

Types of Carbon Credits

- **(i) 'Compliance' credits**:
  - **Kyoto Protocol**
    - **Certified Emissions Reductions** (CERs)
      - **forestry projects a special case for which temporary five-year (tCERs) or longer-term (lCERs) credits issued**
    - **Emission Reduction Units** (ERUs)
    - Assigned Amount Units (AAUs)
    - Removal Units (RMUs)
  - **EU Allowances (EUAs) issued under EU ETS**
  - **National schemes**
    - **E.g. tradable abatement certificates (NGACs) under the New South Wales Greenhouse Gas Abatement scheme**
- **(ii) 'Voluntary' credits**:
  - **Carbon Financial Instruments (CFIs)** - Chicago Climate Exchange
  - **Voluntary Emissions Reductions (VERs): Verified/** Unverified
    - **Range of standards (CarbonFix, CCB, Gold Standard, VER+, VCS)**

UK providers: Carbon Offsets for British forestry projects

Organisation	Website	Type of Organisation	Type(s) of project	Primary market(s)	Types of Credit
Carbon Footprint	www.carbonfootprint.com	Company	R, LPT	Firms, Households	VERs
Carbon Forestry	www.carbonforestry.co.uk	Company	T	Firms, Households	Unverified
Carbon Leaf	www.carbonleaf.co.uk	Company	T	Households	Unverified
Carbon Offset Scotland	www.carbon-offset-scotland.com	Company	T	Households	Unverified
Carbon Responsible	www.carbonresponsible.com	Company	T	Firms, Households	VERs & CERs
Co2balance	www.co2balance.uk.com	Company	A, HN	Firms, Households	VERs (max 90% sold)
Erase my Footprint	www.erasemyfootprint.com	Company	A	Households	Unverified
Future Forests	www.futureforests.co.uk	Company	T, R	Households	Unverified
Grow a Forest	www.growaforest.com	Non-profit Company	A	Households	Unverified
Moor Trees	www.moortrees.org	Charity	A	Households	Unverified
Project Climate	http://projectclimate.org	Company	A	Firms	VERs
The CarbonNeutral Company	www.carbonneutral.com	Company	T, F	Firms, Households	VERs & CERs
The C-Change Trust	www.thec-changetrust.com	Charity	A, CF, HN	Firms, Households	VERs
Treeflights	www.treeflights.com	Company	A, R	Households	Unverified
Trees for Cities	www.treesforcities.org	Charity	U, CF	Households	Unverified

Sources: Ewing (2008), and offset providers' websites.

Notes: A: Afforestation (planting trees where none previously); CF: Community Forestry;
F: Forestry (unspecified); HN: development of habitat networks;
LPT: 'Low profile' tree planting (hedgerows, school grounds, etc);
R: Reforestation/Restoration (planting trees in previously forested areas);
T: Tree planting (unspecified); U: Urban tree planting

UK providers: Carbon Offsets for Overseas forestry

Organisation	Website	Cat	Types of project	Overseas Location(s) of projects	Primary market(s)	Types of Credit
C level	www.Clevel.co.uk	Company	RR	Uganda	Firms, Households	VERs
Carbon Footprint	www.carbonfootprint.com	Company	R, LPT	Kenya	Firms, Households	VERs
Carbon Me	www.carbonme.org	Company	CF, R	LDCs incl. Ethiopia	Households	Unverified
Carbon Positive	www.carbonpositive.net	Company	R	LDCs incl Brazil & Indonesia	Firms, Households	VERs (+ CERs in the future)
Climate Stewards	www.climatestewards.net	Charity	T	Ghana & other LDCs	Households	VERs
Climate Warehouse	www.climatewarehouse.com	Company	F	Worldwide	Firms	VERs & CERs
Co2balance	www.co2balance.uk.com	Company	A, HN	France	Firms, Households	VERs (max 90% sold)
Cool Earth	www.coolearth.org	Charity	D	Brazil, Peru & Ecuador	Firms, Households, Schools	VERs
Correct Carbon	www.correctcarbon.co.uk	Company	R	Panama	Households	VERs
Envirotrade	www.envirotrade.co.uk	Company	R, Ag	Mozambique, Bhutan & other LDCs	Firms, Households	VERs
Flying Forest	www.FlyingForest.org	Company	T	Namibia, S. Africa, Zambia	Households	Unverified
Greenstone Carbon Management	www.greenstonecarbon.com	Company	A, R	Worldwide	Firms	VERs & CERs
GroPower	www.GroPower.net	Company	J	Philippines	Households	VERs
Mycarbondebt	www.mycarbondebt.com	Company	T	India, Tanzania	Households	VERs
Plan Vivo	www.planvivo.org	Non-profit Foundation	CF/Ag	Mexico, Uganda, Mozambique	Firms	VERs
Ripple Africa	www.rippleafrica.org	Charity	T, R	Malawi	Households	VERs
The CarbonNeutral Company	www.carbonneutral.com	Company	T, F	Worldwide	Firms, Households	VERs & CERs
Treeflights	www.treeflights.com	Company	A, R	Peru	Households	Unverified
Trees for Cities	www.treesforcities.org	Charity	U, CF	Peru, Ethiopia, Kenya,	Households	Unverified
World Land Trust – Carbon Balanced	www.carbonbalanced.org	Charity	D, R, RR, HN	Ecuador, Paraguay, Brazil	Firms, Households	VERs & CERs

Sources: Ewing (2008), and offset providers' websites.

Notes: A: Afforestation; Ag: Agroforestry; CF: Community Forestry; D: Avoided deforestation; F: Forestry (unspecified); HN: development of Habitat Networks; J: Jatropha tree planting to use seeds for biofuel (fossil fuel substitution); LPT: 'Low profile' tree planting (hedgerows, school grounds, etc); R: Reforestation/Restoration; RR: Rainforest reforestation; T: Tree planting; U: Urban tree planting. LDCs: 'Less Developed Countries'

2) Approaches to carbon valuation

- **a) Social Value of carbon:**
- **(i) Social cost of carbon (SCC)**
  - Based upon estimated global damage cost of emissions
- **(ii) Marginal abatement cost of carbon (MAC)**
- **(iii) Carbon price / pollution tax** to meet a climate stabilisation goal
- **(iv) Shadow Price of Carbon** (SPC): e.g. tax that equates SCC & MAC
  - **Wide range of estimates:**
    - **SCC estimates span over three orders of magnitude from zero to over £1000/tC (Downing *et al.*, 2005)**
  - **Depend upon approach / model / assumptions (incl stabilisation)**
- **E.g. estimates for stabilisation around 550 ppm CO_2e:**

Source:	US Climate Change Science Program (Clarke et al, 2007)			UK Government (DEFRA) (Price et al, 2007, Table 2)		
Basis:	**Carbon price/tax** (based upon £=$1.309 from Stern Review)			**Shadow Price of Carbon** (2007 prices)		
Model/estimate: Year:	MERGE	MiniCAM	IGSM	Low (-10%)	Central	High (+20%)
2020	**£6/tC**	**£11/tC**	**£57/tC**	£109/tC	**£121/tC**	£145/tC

2b) Market Value of carbon

- **Wide range of prices**
  - **prices in voluntary markets worldwide (excl CCX) ranged from $1.8/tCO$_2$e - $300/tCO$_2$e in 2007 (Hamilton et al, 2008)**
  - **Value depends upon:**
    - **Type of activity & credit**
      - Afforestation, reforestation, reduced deforestation, …
    - **Quality of credit**
      - Duration (e.g. 5-yr tCERs vs longer-term lCERs)
      - timing of benefits & certification (e.g. ex-ante vs ex-post)
      - levels of risk
    - **Demand factors** (incl confidence in offset quality)
    - **Supply factors** (incl certification & other transactions costs)
    - **Regulatory factors** (incl fungibility of credits)
      - **E.g. price of EUAs fell from €30 (April 2006) to under €1 (early 2007) once supply implications of initial allocations under the EU ETS (phase I) became clear**
    - **Related markets** (e.g. oil prices)
    - **Market expectations** (cf 'animal spirits' of investors? - Keynes)

Average market prices in 2007

Mean prices for carbon credits sold in 2007 (US $ at current prices)

Type of credit:	Share of credits (%)	Price ($/t$CO_2$e)	Price ($/tC)
Primary CERs	18.5	13	49
Secondary CERs	8.0	23	83
ERUs		16	60
Other project-based credits	1.4	6	23
All project based credits	29.3	16	57
EUAs		24	89
NGACs		9	33
CFIs		3	11
All Allowance based credits	70.7	24	88
All credits		21	79

Source: volumes and values from Capoor and Ambrosi (2008, Table 1, p.1).
Notes: primary transactions where the original owner or issuer sells the credits.
secondary transactions where the seller is not the original owner or issuer.

3 Future carbon values: comparing benefits over time:

Discounting for:

- **(i) Time**
  - **Time preference:**
    - Preference for benefits sooner rather than later
      - often considered an accurate description of behaviour
- **(ii) Changing circumstances**
  - Diminishing 'marginal utility'
    - If individuals/society expect to become more wealthy over time
  - Risk/uncertainty aversion
    - Future benefits more risky / less certain
  - (Damage - e.g. negative discounting for **increasing damage caused by carbon emissions at higher atmospheric concentration**)

3a) Social Discount rates:

- **Rate of Social Time Preference** (elements):
  - rate at which future consumption is discounted compared to current consumption if no change in level expected
  - expected rate of growth of per capita consumption
  - elasticity of the marginal utility of consumption
- **Rates applied vary** (no international standard)
  - declining ('hyperbolic') rates in some cases
    - E.g. Treasury Green Book (Table 6.1, p.99) declining rate
      - 3.5% (yrs 0-30); 3.0% (yrs 31-75); 2.5% (yrs 76-125)…1%
  - rates used can depend upon the purpose
    - E.g. marginal vs non-marginal (avoid all impacts) decisions
      - Stern Review (2006) used lower rates than Green Book

DEFRA Shadow Price of Carbon

DEFRA Shadow Price of Carbon, discounted, and implicit discount factor

Year	**SPC** in **£/tCO$_2$** (2008 prices)	**Discounted SPC** in **£/tCO$_2$** (2008 prices)	**Discount factor**
2008	26.5	26.5	1.000
2020	33.6	22.2	0.839
2030	40.9	19.2	0.725
2040	49.9	16.8	0.633
2050	60.8	15.2	0.574
2100	164	10.1	0.383
2150	440	8.6	0.326
2200	1185	8.6	0.326
2250	3193	10.6	0.400

Sources: SPC up to 2050 taken from DEFRA guidance (Price et al, 2007, Table 3);
Discounted and post-2050 estimates based upon Green Book discount rates;
Social Value assumed to increase at 2% pa due to increasing damage cost

3b) Market Discount rates:

- dependent upon factors including:
  - Expected future market conditions for carbon credits
    - expected future market prices
  - Preferences and perceptions of buyers
    - expectations about levels of risk & uncertainty
      - attitudes to risk (risk-averse, risk neutral, etc)
    - extent of willingness to delay carbon benefits
  - Regulatory factors
    - e.g. fungibility and opportunities to bank credits

Is forestry carbon undervalued?

4a) Valuation & allowing for non-permanence (e.g. fire) risks:

- **(i) Discounting**
  - E.g. future carbon benefits with a risk of x% that they fail to materialise may be valued at (100-x)% of a benefit that is certain by a risk-neutral decision-maker
    - cf 'certainty equivalent'
- **(ii) Maintaining a Buffer**
  - Credit issuers withhold proportion of credits to cover risks
  - akin to discounting but increases rather than decreases value of a credit
  - **several voluntary standards use this approach, including:**
    - **CarbonFix Standard: 30%**
    - **Voluntary Carbon Standard: 5%-60% depends whether**
      - **'low', medium' or 'high' risk category (and project type)**
- **(iii) Temporary crediting (limiting duration of credits)**
  - **Excludes entirely benefits accruing beyond specified time**
  - **eliminates need to consider more distant risks**
  - **Used for Kyoto credits (under CDM):**
    - **5 years (tCERs) or remaining project duration (lCERs)**
  - **Used by some voluntary market standards: VER+ (max 50 years)**
  - **Effect on value of credits also depends upon replacement requirements**
    - **E.g. Kyoto credits lCERs & tCERs have to be replaced on expiry**

4b) Other risk management approaches

(not directly involving carbon valuation) include:

- **(d) Ex-post (rather than ex-ante) crediting**
  - **Reduces/eliminates need to consider future risks**
    - **E.g. Kyoto credits (CERs, tCERs, lCERs…)**
  - **but risks still remain for some ex-post credits**
    - **E.g. forward delivery of Kyoto credits (gCERs)**
- **(e) Insurance**
- **(f) Portfolio management**

4) Concluding Remarks (Social Values):

- current DEFRA guidance:
  - Assumption of stabilisation at 450ppm-550ppm:
    - Slow progress in international negotiations
    - Accelerating carbon emissions
      - Current concentration 383ppm growing at over 2ppm pa (GPC, 2008)
      - emissions growth rate exceeds most fossil fuel intensive scenario considered by IPCC?
    - If over-optimistic, **carbon values too low?**
  - Assumption of declining discount rate protocol starting at 3.5% (from the Treasury Green Book):
    - Use of lower discount rates (e.g. Stern Review/Weitzman)
    - if discount rate too high, **future carbon values too low?**
- **If either hold, forestry carbon will tend to be undervalued**

Is forestry carbon undervalued?

- **i) Avoided deforestation:**
  - UNFCC process (post-Bali)
  - **developing markets for forestry C of central importance to tackling climate change (Eliasch Review, 2008)**
- **ii) Demand reduced by virtual exclusion of forestry carbon from :**
- a) public codes on carbon offsets
  - **DECC Code of best practice for Offset Providers**
- b) National carbon accounting frameworks
  - e.g. **DECC proposals on Carbon Units, the net UK carbon account & carbon accounting**
    - virtual exclusion of forestry carbon at present
- c) European emissions trading schemes
  - e.g. **EU ETS**

Concluding Remarks (valuation methods):

- methods of valuing carbon and risk management that could be used in **further extending standards to forestry** (implicitly establishing an exchange rate between different types of credits) include:
  - Discounting:
    - Public (social) discounting rather than market approach may be preferable (less open to potential manipulation by participants)?
  - Buffer:
    - need for impartial risk assessments
      - Role for central designated body (setting rules)?
  - Temporary crediting:
    - need for consistent approach to valuing benefit streams for different lengths of time

Concluding Remarks (general):

- incentives to conserve existing forests and to plant new ones are important for the potential of forests for climate mitigation to be realised.
- Current UK government offset standards and proposals on carbon accounting will do little to ensure such incentives are provided (excluding most forestry)
- There appears a strong argument for extending these schemes/proposals to forestry carbon more widely
- Several methods are available to cover risk management (e.g. non-permanance) and other quality issues apart from simple exclusion
- Without incentives to value forestry carbon significant climate mitigation opportunities are likely to be missed:
  - virtual exclusion results in forestry carbon being undervalued

Next steps (further work):

- **1) Additionality: Review of concept/usage**
  - a) Types (statutory, investment/financial, environmental)
  - b) Tests & evidence required
    - i) regulatory
    - ii) voluntary market standards
- **2) Comparative analysis of silvicultural options (valuing carbon sequestration & substitution profiles)**

- **Thanks for listening!**