ECONOMICS OF DESERTIFICATION, LAND DEGRADATION AND DROUGHT (DLDD) IN INDIA

ECONOMIC ESTIMATES & VALUATION: A REVIEW OF THE LITERATURE

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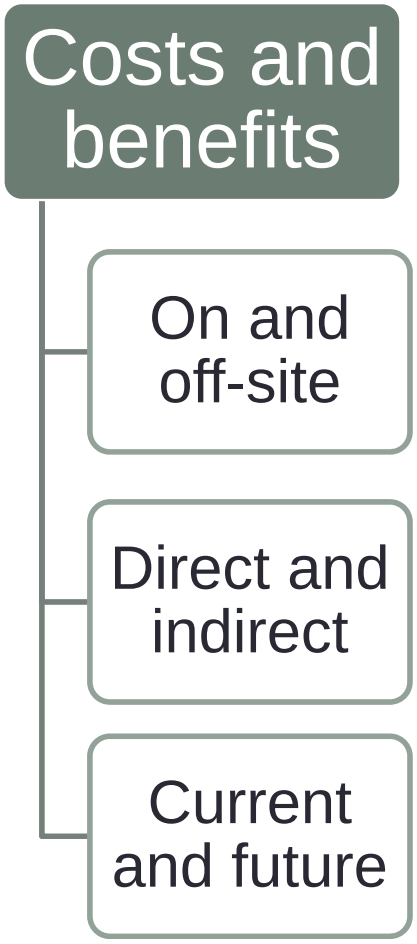
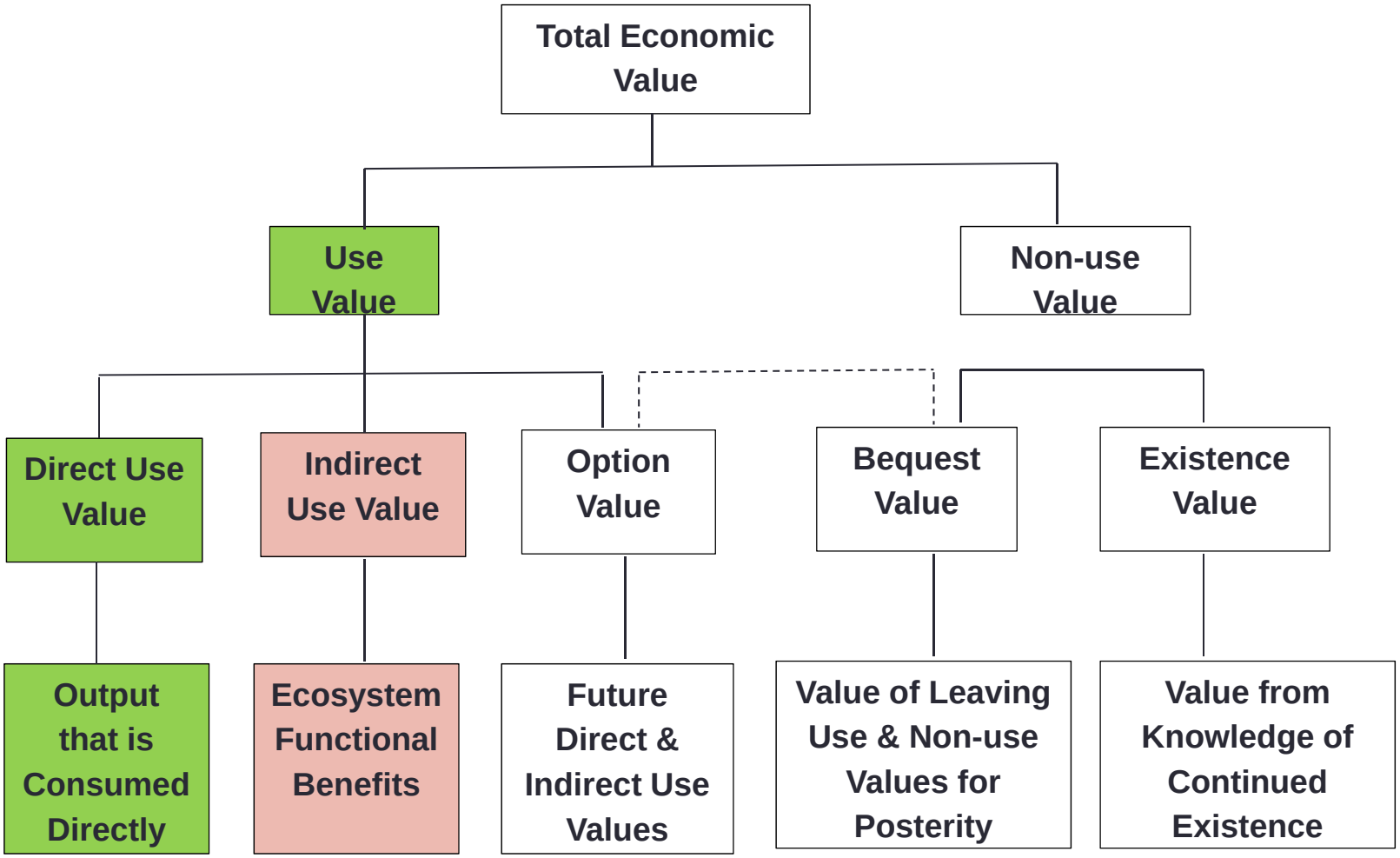
DLDD- impacts



- Direct onsite costs
  - lower agricultural productivity and resulting loss of income (MT-LT)
  - loss of biodiversity (LT)
  - loss of vegetation (LT)
- Indirect offsite costs
  - siltation of rivers, reservoirs and irrigation canals which can reduce their effectiveness and increase flooding
  - impacts of dust storms on human health, ecosystems, and transport infrastructure
- Direct/indirect offsite benefit
  - redeposition of soils in lowland areas where productivity may improve
- Indirect long-term economy-wide costs
  - reduction in agricultural production and income can impact migration, food security, and poverty through multiplier effects
  - soil erosion which reduces reservoir capacity can lead to electricity outages in turn adversely affecting production industry, with long-tern impacts on government spending

Total Economic Valuation Framework



Select studies for India

Study	Scope	Method	Key results
TERI 1997	**Onsite**: Loss of production due to erosion by water and wind; loss of nutrients, salinization and water logging **Offsite:** Loss of production due to reduced area under irrigation due to siltation of reservoirs	**Loss of Production** disaggregated for 3 levels of severity of land deg and 11 crops) ***Value transfer***	Rs. 39-232 bn = approx 11%-26% of the potential yield of the eleven crops considered
Reddy 2003	**Onsite:** all categories of land degradation (water and wind erosion, salinity, alkalinity, waterlogging, degradation due to cultivation practices, industry- and mining related degradation etc.)	**Loss of production** **Replacement cost** ***Value transfer*** **Loss of production using a district-level production function**	Loss of production: Rs 75 bn (1988) - Rs 449 (1994) Replacement cost: Rs 25 bn (1988) Rs 185 bn (1994)

…select studies for India

Study	Scope	Method	Key results
World Bank 2012	**Onsite:** • Cost of soil salinity, waterlogging and nutrients loss • loss of fodder and livestock income due to due to rangeland degradation	**Loss of production** (Soil salinity and waterlogging) considering only wheat; rangeland degradation **Replacement Cost** (nutrient loss) ***Value transfer***	Rs. 715 billion Rs. or 1.1 % of GDP in 2010 Rs. 405 billion or 0.6% of GDP in 2010
Sharda et al 2009, Sharda and Mandal 2013	**Onsite**: Loss of production of major cereal, oilseed, and pulse crops cultivated on rainfed areas of India due to soil erosion by water. .	**Loss of production** ***Experimental data*** of a crop integrated with the rainfed area of that crop under each erosion intensity category for three major soil groups (alluvial, black and red) in a state	At state level, productivity loss in • rainfed cereals :0.2–10.9 q/ha • oilseeds 0.1–6.3 q/ha • pulses 0.04–4.4 q/ha India suffers a loss of 1.63 q/ha in productivity of rainfed crops, valued at Rs. 2,484/ha. Annual production losses of 13.4 Mt valued at Rs. 205 bn in 2011/12

Select international studies

Study	Scope	Method	Key Results
Bejranonda et al 1999	**Offsite**: Effects of policies (upstream soil conservation practices and downstream dredging) to control agricultural sedimentation on lakeside property values at 15 Ohio state park lakes	**Hedonic pricing**	Implementing the upstream soil conservation practices generally provide more economic benefits to downstream lakeside residents in terms of increasing property rent than increasing average depth of the lakes through dredging
Hansen and Hellerstein 2007	**Offsite**: Impact of soil conservation on reservoir services	An extension of the **replacement cost theory** which calculates parameters of the reservoir benefit function based on observed costs	Across the 2111 US watersheds, a one-ton reduction in soil erosion provides benefits ranging from zero to $1.38. In a policy application, the lower soil erosion level in 1997, relative to 1982, was shown to have conserved $154 million in reservoir benefits

…select international studies

Study	Scope	Method	Key Results
Colombo et al 2006	**Offsite**: benefits of programmes to mitigate the off-site impacts of soil erosion for a watershed in Andalusia, Spain	**Stated preference methods** - choice experiments and contingent valuation	Social value of reducing off-farm effects of soil erosion in the catchment estimated at €95–160/ ha as compared to a per hectare subsidy given to farmers that adopt soil conservation measures (€132/ha/year)
Dia and Sapro, 2007	**Economy-wide costs** of soil erosion taking into account economy-wide linkages between production and consumption across sectors	**Economy-wide, multimarket model** which integrates the effects of soil erosion on crop yields at the subnational regional level for eight main staple crops	Model predicts that land degradation reduces agricultural income in by US$4.2 bn over 2006–2015, which is about 5% of agricultural GDP during the period. Soil loss leads to 5.4% increase in poverty rate in 2015 compared to the case of no soil loss

A review of estimation methods

Type of value	Example	Technique	Limitations
Onsite direct cost	Loss of agricultural output	Productivity change/ production function based	• Relationship between change in ecosystem service and production level- disentangling other effects • Appropriate benchmarks • Non-linearities, adaptive capacity etc.
	Nutrient loss due to soil erosion	Replacement cost	• Assumption that artificial replacement is equivalent • Potential offsite costs of artificial replacement
Offsite costs	Impacts of sedimentation of water bodies on irrigation, hydropower, navigation, water treatment	Damage costs/averting mitigation costs	• Avoided costs may not be equal to benefits of ecosystem services
Non-use values	People's valuation of land attributes	Stated preference, hedonic pricing, travel cost	• Potential biases; context specific (CV) • Assumption of well-functioning land markets (HP) • Limited to recreational benefits of land (TC)
Indirect cost		Mathematical /econometric modeling	• Modeling of economy-wide linkages

Some observation from the literature

- Main focus has been on direct agricultural productivity impacts of soil erosion
- DLDD is highly site-specific, occurs over time in a non-linear way therefore up-scaling is a challenge
- Limited peer reviewed work which is symptomatic of limited consensus on acceptable levels of rigour, and a structured evolution over time in the sophistication of its methods (UNCCD 2013)

THANK YOU