ECOSYSTEM VALUES ASSESSMENT & ACCOUNTING (EVA):

INTRODUCING AN ANALYTICAL FRAMEWORK FOR PTEC CONSIDERATION

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Outline

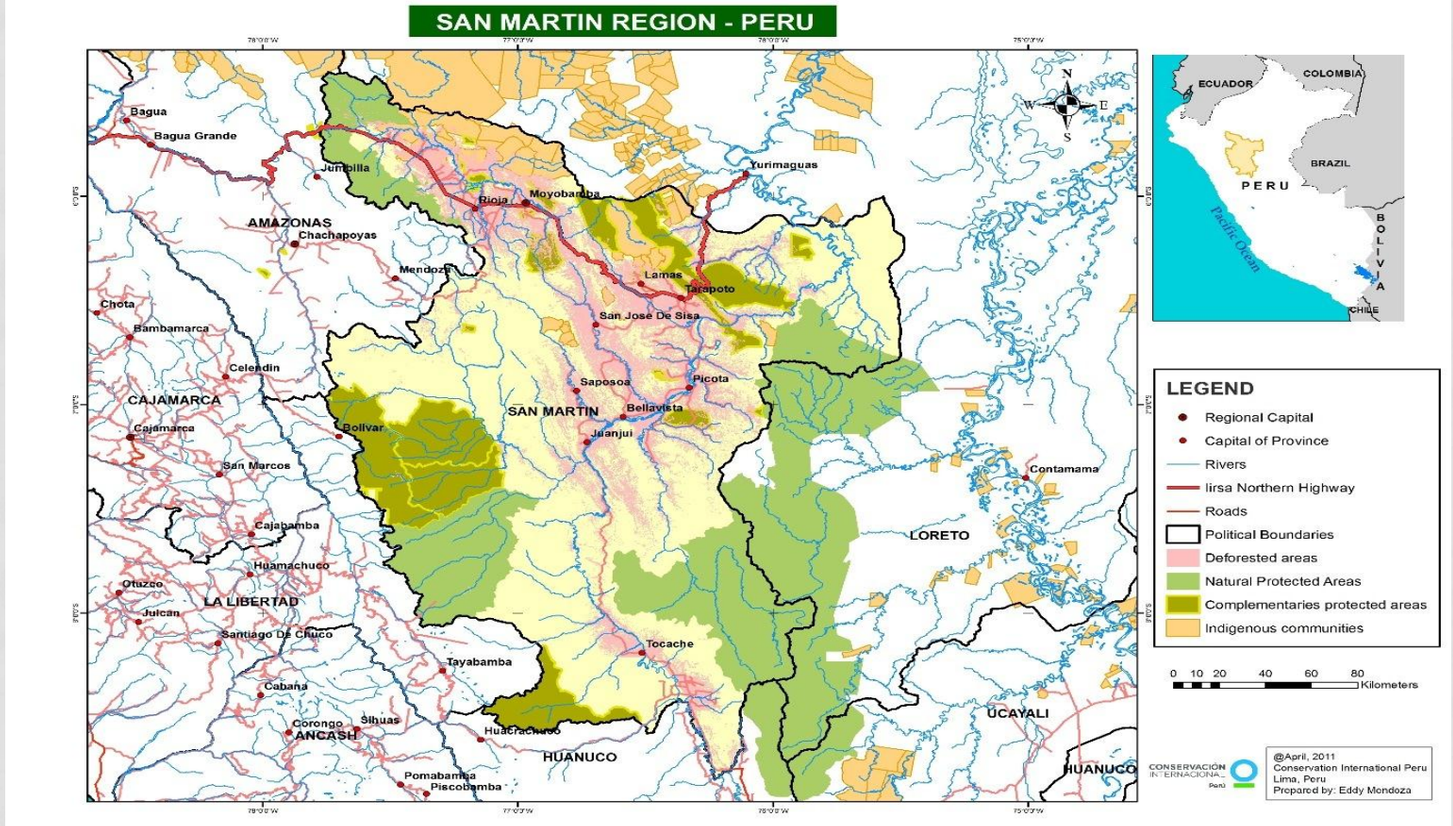
- EVA background
  - Goals, focus and funding
- Analytical framework
  - Principle elements
  - selection of priority ecosystem services
  - Methodological approaches: Biophysical and Economic valuation
- Challenges and issues

Background: Project goals, focus and funding

Goals:

(1) The EVA-Peru pilot aims to design and field-test a replicable and scalable framework for incorporating nature's benefits into decision-making.

(2) EVA's ultimate goal is to make explicit the relevance of natural capital to the economy and inform more sustainable policies and practices



Focus: SEEA Experimental Ecosystem Accounting

Funded by: the Moore Foundation
Implemented by: CI MCSO, CI Peru with support from GoP and San Martin

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Background: Selection of priority ecosystem services

Selection criteria:

(1) relative contribution to HWB

(2) importance to stakeholders

(3) risk of deg

(4) policy sen

(5) feasibility t

(6) data avai

Strategic goal
Sustainable development
Ecosystem-base management

Priority ecosystem services for the pilot

- Water supply
- Timber and non-timber forest products
- Climate regulation
- Pollination
- Erosion control
- Cultural services (tourism)
- Biodiversity

Matrix for workshop exercise to rank ES based on perceived relative importance		
Ecosystems	Ecosystem goods and benefits	Relative importance (on a scale 0 to 5) *
Wetlands	Potable water	5
Forest	Non-timber forest products	3.8
Forest	Timber products	3.7

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Analytical Framework

Ecosystem Value, Assessment and Accounting

Methodological Framework and Design

Moore Center for Science and Oceans – MCSO
CI-Peru

October 2014

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Documenting internal consensus on the interpretation of current literature related to ecosystem accounting

- Conceptual clarity
- Choices for methodological approaches
- Communication and engagement with partners and clients

Principle elements of the pilot: Ecosystem Assets Accounts

	Ecosystem Accounting Units (political region, watershed, and/or land tenure and management class)
Ecosystem Asset	E.g. Watershed 1
Palm swamp forest	
Shrub thicket	
Paramo/grassland	
Lowland forest	
…	

Ecosystem Assets

Ecosystem Assets	Opening Stock time XXXX	Palm swamp forest	Shrub thicket	Lowland forest	…	Net change (increase-decrease)	Closing area, time XXXX
Palm swamp forest							
Shrub thicket							
Paramo/grassland							
Lowland forest							
…							

Economic sectors

Ecosystem Assets	Opening area time XXXX	Agriculture	Forestry concessions	…	Net change (increase-decrease)	Closing area, time XXXX
Palm swamp forest						
Shrub thicket						
Paramo/grassland						
Lowland forest						
…						

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Principle elements of the pilot:
ES physical and monetary stock accounts

Year	Ecosystem Accounting Units			
Ecosystem services	**Forests**	**Wetlands**	**Grasslands**	**-------**
Timber resources				
Non-timber forest products				
Pollination				
Water provision				
Sediment control				

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Principle elements of the pilot:
ES physical and monetary flow accounts

Year	Ecosystem Accounting Units (political region, watershed, land management zone, tenure etc)			
Ecosystem services	E.g. Watershed X			
	Economic sectors			
	Economic sector 1		Economic sector …	
	Physical measurement	Monetary measurement	Physical measurement	Monetary measurement
Timber resources				
Non-timber forest products				
Pollination				
Water provision				
Sediment control				

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Principle elements of the pilot: Biodiversity accounts

		Species Assets			
		Plants	Animals	Birds	Species X
Opening stock of resources Year XXX					
Additions to stock of species assets					
	Managed expansion				
	Natural expansion				
	--				
Total additions to stock of species assets					
Reductions in stock of species assets					
	Managed regression				
	Natural regression				
	--				
Total reductions in stock					
Closing stock Year XXXX					

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Economic valuation: Methodological plurality

Methods	Application (scale)	Metrics/ What it measures	Strengths	Weaknesses	Examples
Total value of crops	National Regional Global	Yield of crops Market prices	Only few early studies showed the magnitude of importance of pollinators in agriculture	Overly simplistic Does not consider production costs Does not consider market dynamics	Levin (1994) Costanza et al (1997)
Market price	Local Regional	Crop production area Honey-bee stocking rate Honey bee rental costs	This is a cost-based approach using the actual market price of honey-bee pollination used as a production input	Only applicable if pollinator is domesticated honey bee Only applicable if honey bee is rented, ignores wild pollinators	Rucker 2012 Winfree et al (2011)
Production function	Farm	Crop yield Area Market price Variable costs	It attributes pollination services to its habitats (e.g. nearby forest patches)	Limited applicability at national scale due to large computation and spatial modeling involved	Ricketts et al (2004)
Net return to pollination	Farm	Costs of production inputs Commodity value	Pollination is assumed to be an input to production	Cannot be applied in larger scale Not yet applied in pollination service	No example found
Replacement costs	Farm Local Regional	Crop yield Market price	Damage costs are estimated	Doesn't take into account production costs	Allsopp et al (2008)
Experimental	Farm Local	Pollinator abundance Nesting area Visitation rate	It models the relationships among pollinator abundance, nesting area, visitation rate etc in a spatially explicit way	Difficult to use in larger scale due to limitations associated with data and spatial analysis	Olschewski et al (2006)
Dependency ratio	Local Regional National	Crop yield Market price Variable costs Dependency factors	This method was tested widely Can be applied in a wide range of scales Data can be obtained from national statistics	Data intensive Dependency factors are often difficult to compute	Morse and Calderone (2000) , Gallai et al (2009) , Carreck and Williams (1998), Barfield et al (2012) ; Sinnathamby et al (2013)

Example: Pollination

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ECONOMIC VALUATION: AN APPROACH TO POLLINATION

$$EVP = \sum_{i=1}^{I}(FGV_i D_i) = \sum_{i=1}^{I}(P_i Q_i D_i)$$

$$\sum_{i=1}^{I}((P_i Q_i - VC)D_i)$$

$$(0 \leq D_i \leq 1)$$

Here i refers to the type of crop, FGV_i is the farm-gate value of crop i, P is the producer price, Q is the quantity produced for i^{th} crop, VC is the variable cost and D is the dependence ratio.

Sinnathamby et al (2013); Barfield et al (2012); Gallai et al (2009); Klein et al (2007); Morse and Calderone (2000); Carreck and Williams (1998).

D is measured as $1-(f_{pe}/f_p)$, where f_{pe} = fruit set under conditions of pollinator exclusion and f_p = fruit set with insect pollinators present.

Economic valuation: Pollination preliminary results for Peru (2012)

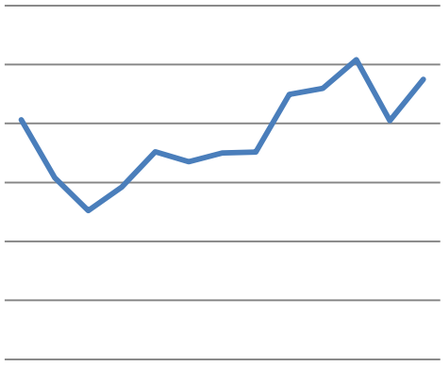
Crops (i)	Total[1] production (Q_i)[2] (T)	Farm-gate price (P_i) ($/T)	Variable cost (VC_i)	Dependency Ratio (D_i)	EVP_i
Apples	147114	268.9	107.56	1	23735372.8
Apricot	240		0	0.7	0
Asparagus	376645	1060.6	424.24	1	239681812
Avocado	215000	772.7	309.08	1	99678300
Cherries, sour	1244	217.4	86.96	0.9	146040.624
Coffee	303264	2401.5	960.6	0.1	43697309.8
Cotton seed	55000		0	0.2	0
Grapefruits	5493	189.4	75.76	0.8	499379.616
Grapes	365114	829.5	331.8	0.1	18171723.8
Lemons and limes	234096	348.5	139.4	0.25	12237368.4
Lettuce and Chicory	53111	242.4	96.96	0.1	772446.384
Melons & Cantaloupe	21053	257.6	103.04	0.7	2277766.18
Olives	92527	647.7	259.08	0.1	3595784.27
Onions	775458	363.6	145.44	1	169173917
Orange	424975	212.1	84.84	0.3	16224695.6
Peach	47416	750	300	0.6	12802320
Pears	4434	572	228.8	0.7	1065224.16
Green peas	117555	507.6	203.04	0.5	17901275.4
Plum	7864	299.2	119.68	0.7	988221.696
Pumpkins	221527	178	71.2	0.9	21293175.2
Soybeans	2251	856.1	342.44	0.1	115624.866
Strawberries	30481	424.2	169.68	0.2	1551604.82
Tangerines, Mandarins	280954	367.4	146.96	0.5	30966749.9
Tomato	229322	291.7	116.68	0.5	20067968.2
Water melon	94754	212.1	84.84	0.7	8440875.83

Data source: FAO, Ministry of Agriculture

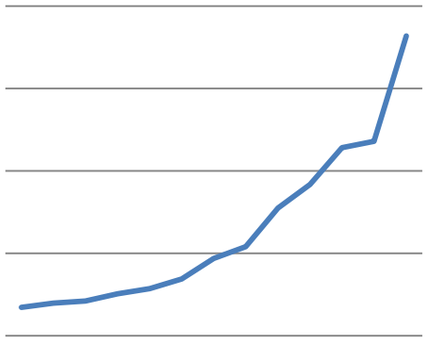
Economic valuation: Pollination Trends

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
US$ (millions)	194.8	174.5	174.2	186.5	195.7	257.4	293.6	372.1	393.1	444.3	505.2	605.8	745.1

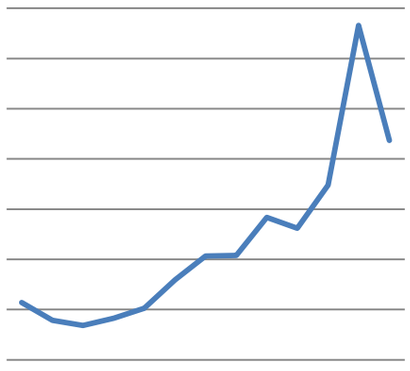
Apples



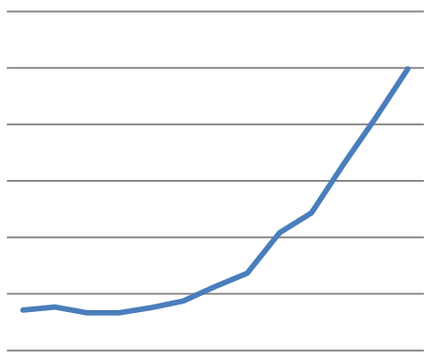
Grapes



Coffee

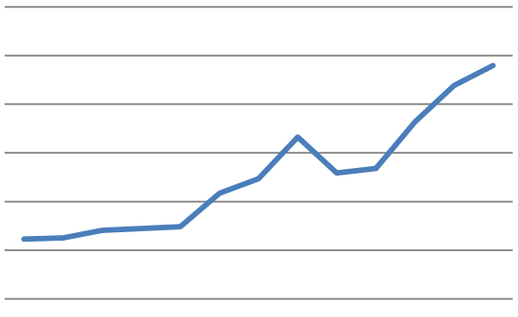


Avocado



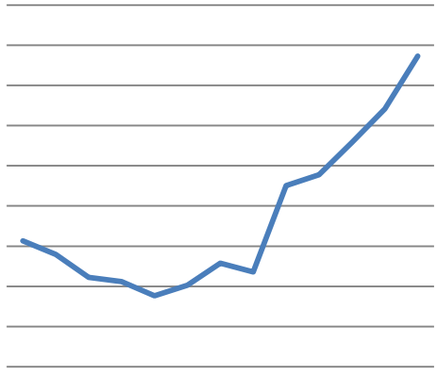
Tomato

Asparagus

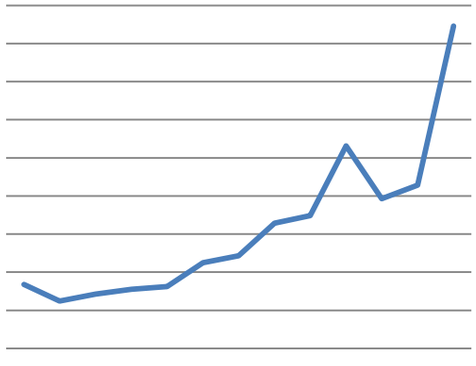


Melons & Cantaloupe

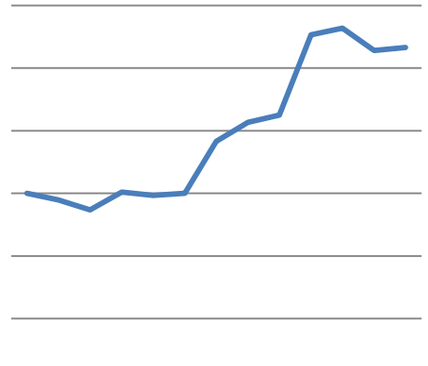
Lettuce and Chicory



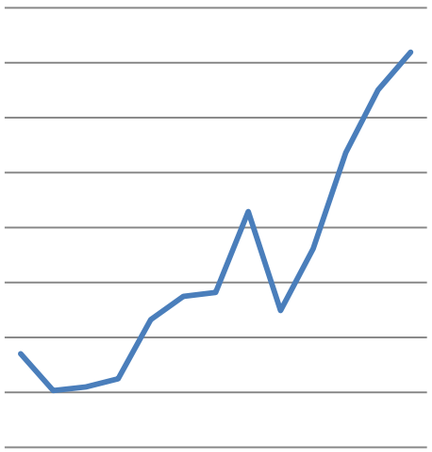
Onions



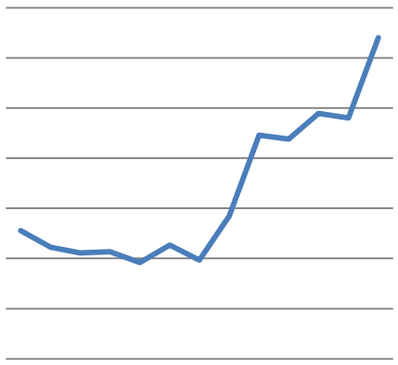
Pears



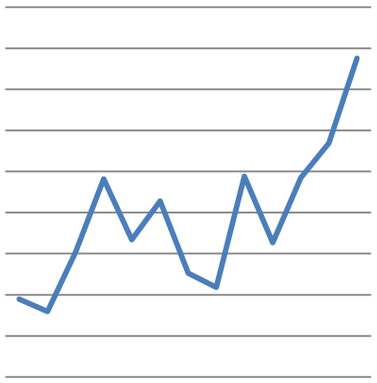
Olives



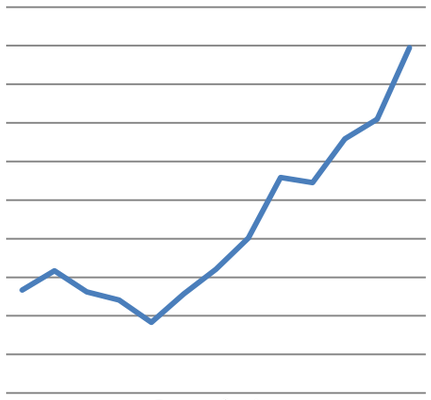
Peach



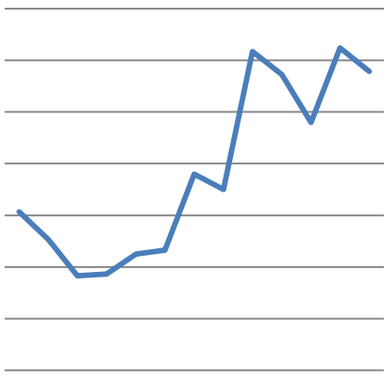
Strawberries



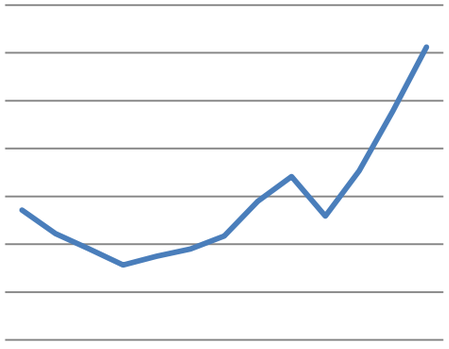
Green peas



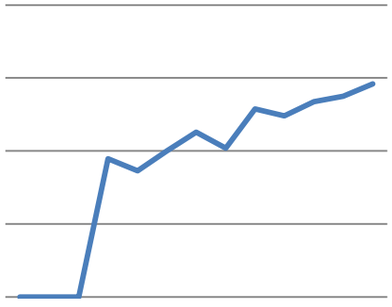
Soybeans



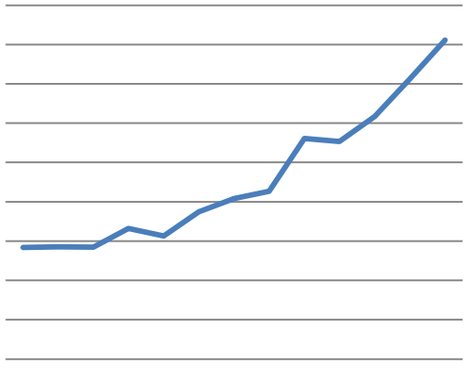
Lemons and limes



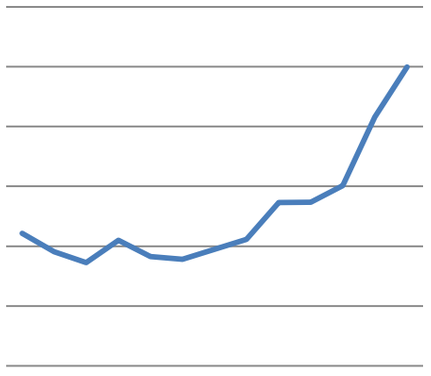
Cherries, sour



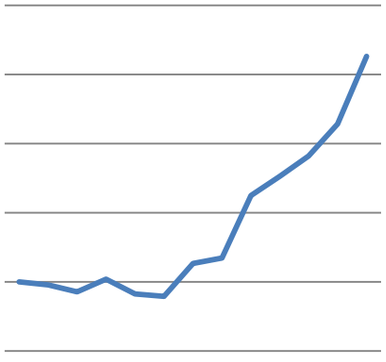
Orange



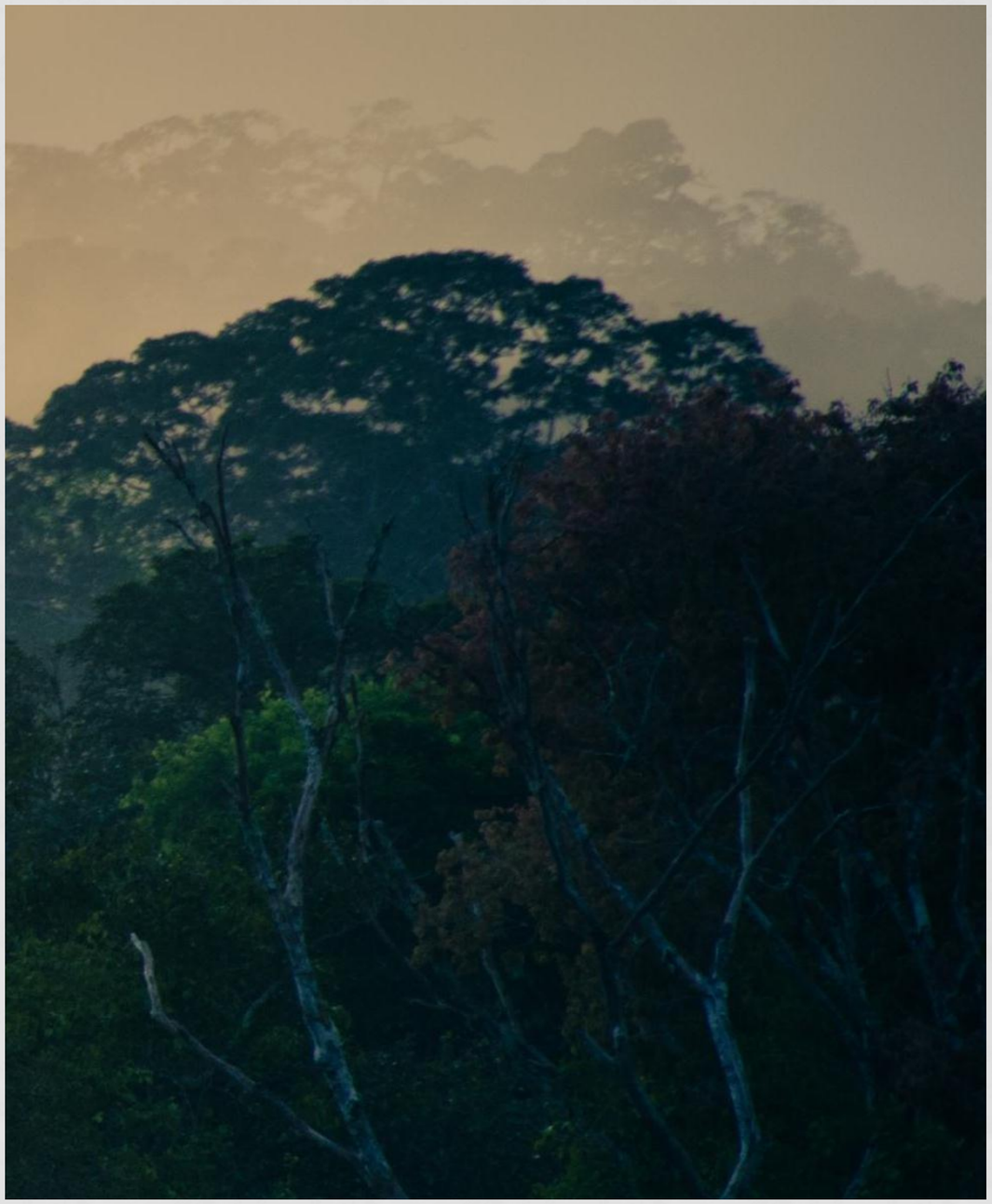
Grapefruits



Pumpkins



Issues and challenges



- Assessment of Expected Ecosystem Services Flows
- Managing uncertainties
- Measuring sustainability, degradation and depletion
- Methodological: Precision vs generalization

THANK YOU!

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