



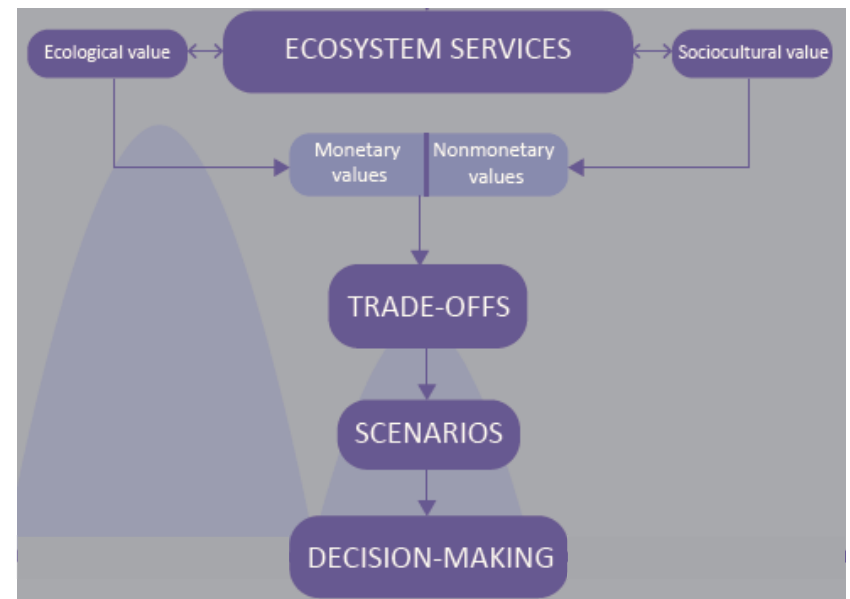
Assessing ecosystem service tradeoffs for decision-making : A comparison of methods in Costa Rica

Vallet A.; Locatelli B.; Levrel H.; Wunder S.



Decision-making affect the level of ES

- Decision-makers make choices for managing landscape
(Rincón-Ruíz et al. 2014)
 - They have direct and indirect effect on levels of ES (Haase et al. 2012)
 - They must be aware of positive or negative interactions between ES
 - Bring multiple services simultaneously
 - Create win-win opportunities
- (Haase et al. 2012; Turner et al. 2014; Howe et al. 2014; Bennett et al. 2009)



(Rincón-Ruíz et al. 2014)

Describe and quantify ES relationships

- Several definitions and typologies of ES relationships
(Rodríguez et al. 2006, Bennett et al. 2009, Mouchet et al. 2014, Bennett et al. 2009)
- 3 types of relationships are usually considered:
 - Synergies - Situations in which both services either increase or decrease
 - Tradeoffs - Situations in which one service increases and another one decreases
 - No effect (Bennett et al 2009; Lee and Lautenbach 2015)
- Different methods are used to quantify relationships
(Lee and Lautenbach 2015; Mouchet et al. 2014)

There is a need for comparing methods and highlighting their different contributions to decision-making

Research question and objectives

- Do different methods for assessing ES relationships yield different results?
 - What method choose to inform which decision-making processes ?
- Test 3 methods for assessing nature and intensity of relationships between ES in Costa Rica

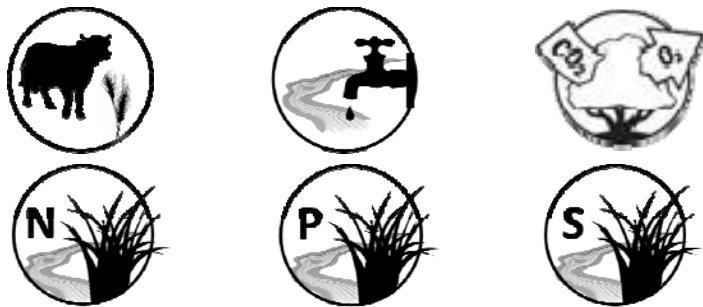


Application in Costa Rica



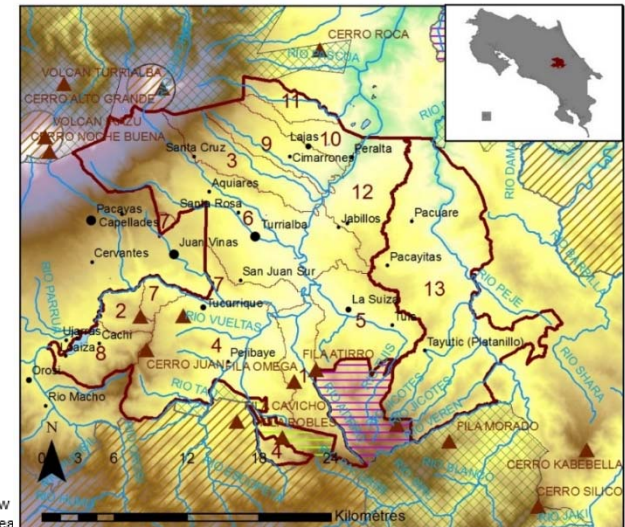
- Modeling of 6 ecosystem services using InVEST

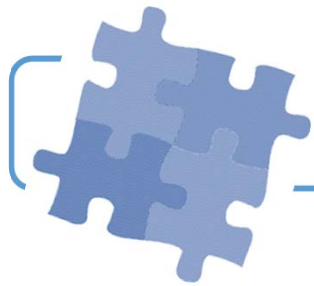
(Vallet et al. 2016)



- 13 subwatersheds
- 4 observed land-use maps in 1986, 1996, 2001 and 2008
- 32 scenarios of land cover

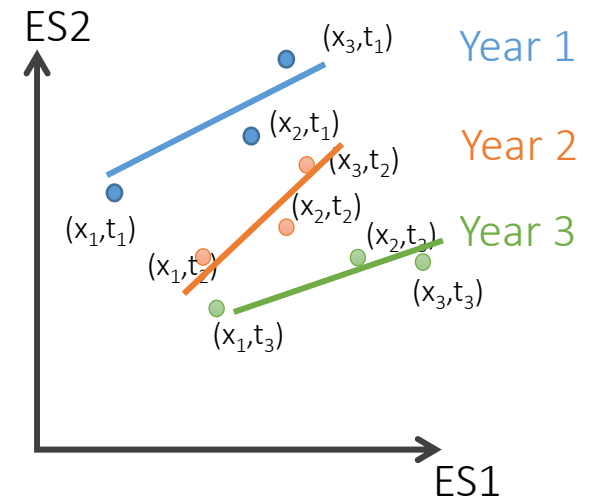
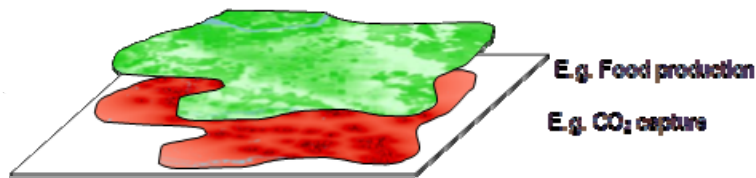
Central Volcanic-Talamanca Biological Corridor





Method 1

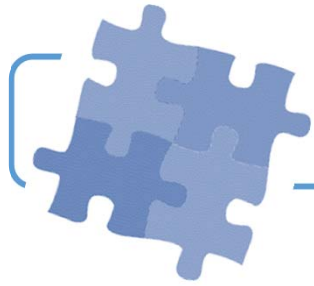
Co-occurrence of ES



- Overlap of ES is interpreted as a relationship
- Static approach but relationships can change overtime
(Renard et al. 2015; Zheng et al. 2014)

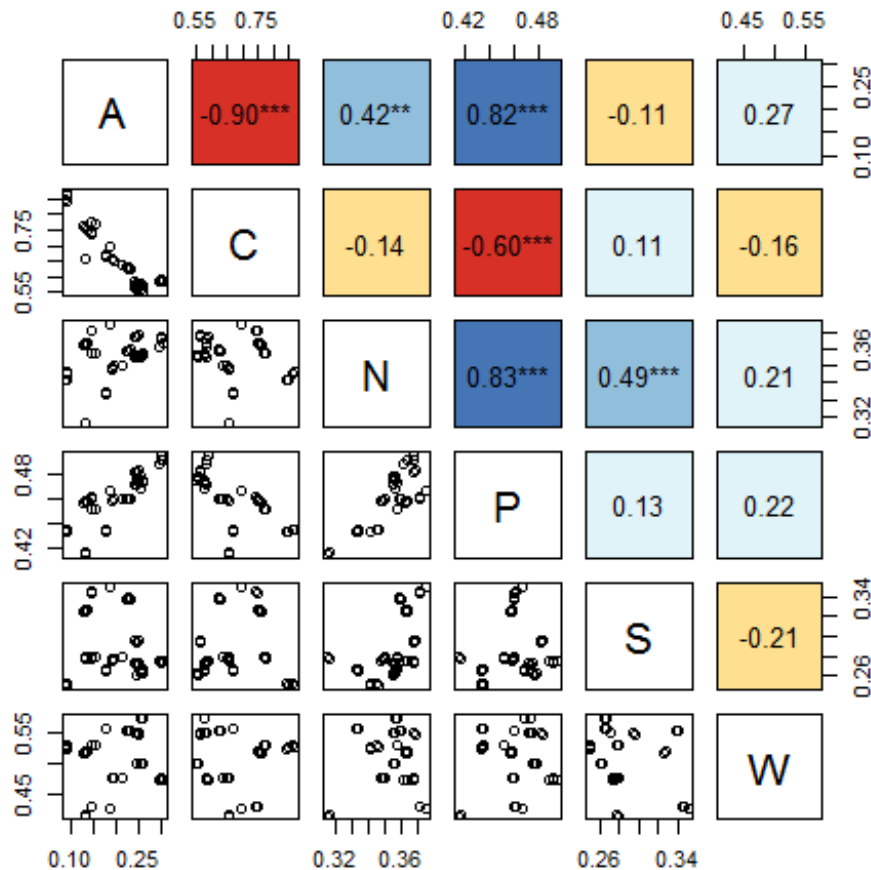
- Quantified using correlation coefficients
- Most commonly used method in literature

(Lee and Lautenbach 2015)



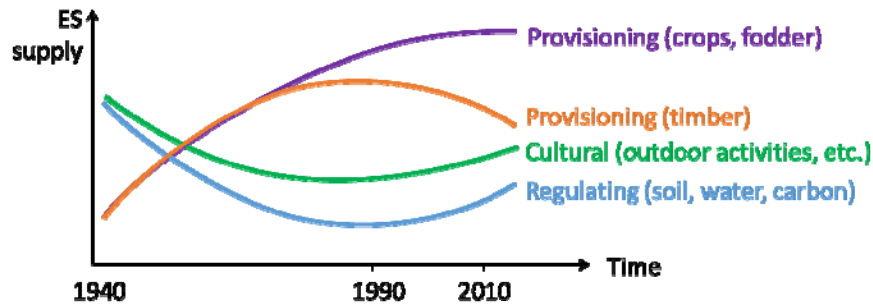
Method 1

Results and implications

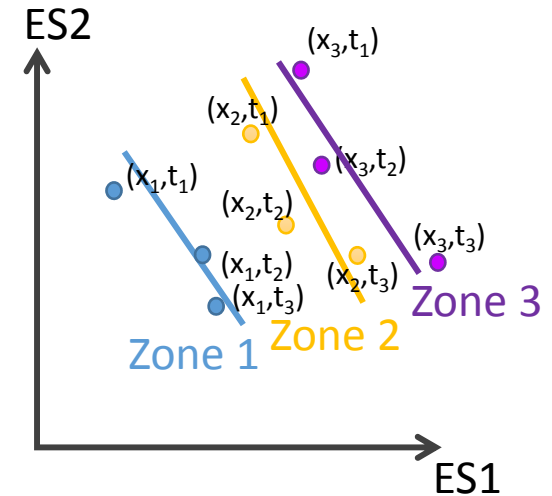


- Do not inform on mechanisms
- Define priorities
 - Conservation in hotspot
 - Restoration in coldspot
 - Zoning for money allocation
- Characterize landscape (bundles)
- Identify multifunctional areas and land uses (agroforestry)

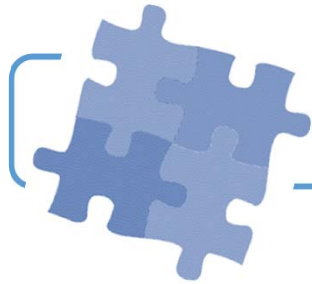
Method 2



Co-variation of ES

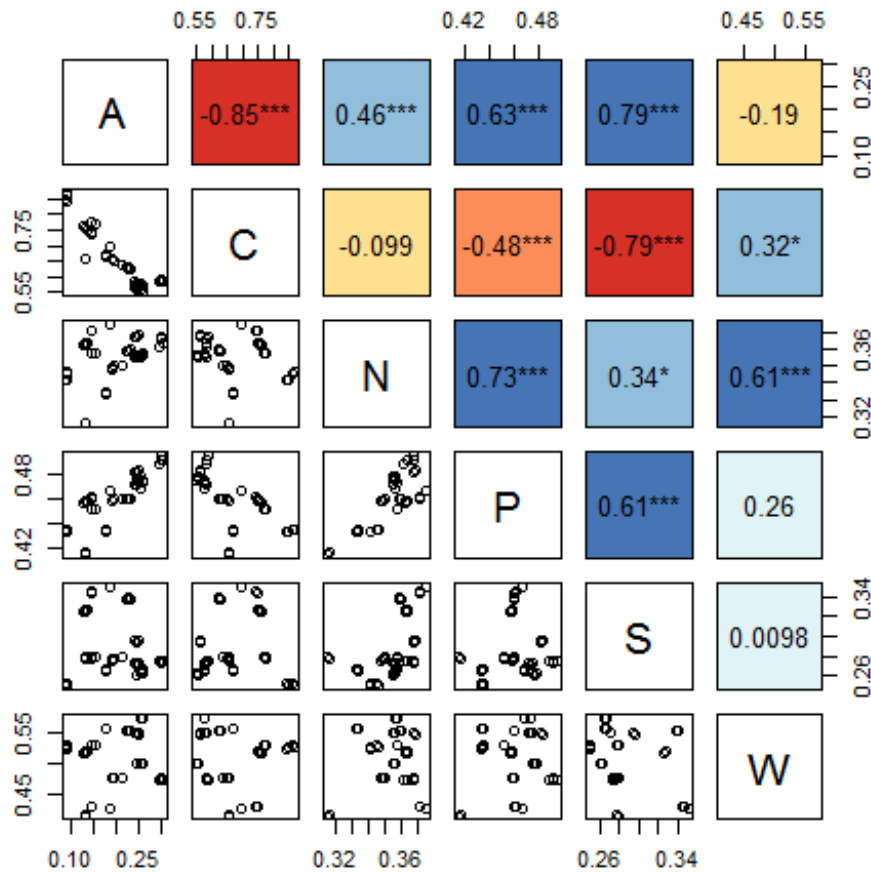


- Similarity of ES trends over time is interpreted as a relationship
- Dynamic approach
- Quantified using correlation coefficients on ES changes
- Rarely used in literature (Tomscha and Gergel 2016; Zheng et al. 2014)

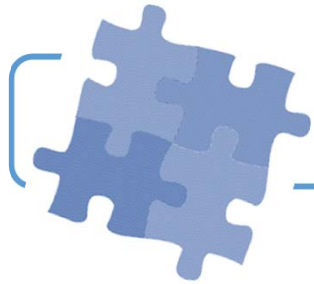


Method 2

Results and implications



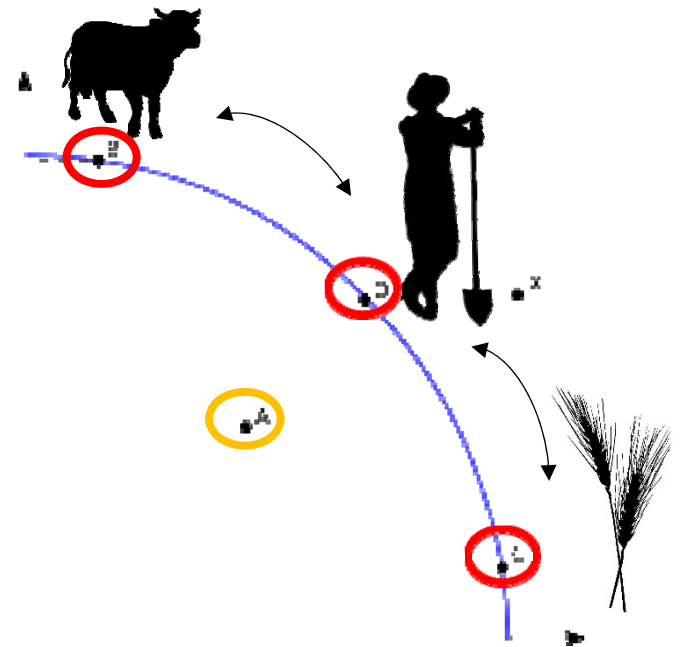
- Do not inform on mechanisms
- Identify common response to common drivers
- Assess ES levels in the future or in scenarios

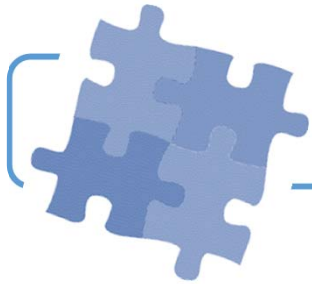


Method 3

Production Frontier

- Production theory in microeconomics
- Describe how to convert an input (ex: land) into various outputs (ex: cropping or cattle farming)
- Production frontier is the set of optimal combination of outputs
- Points below the frontier are sub-optimal

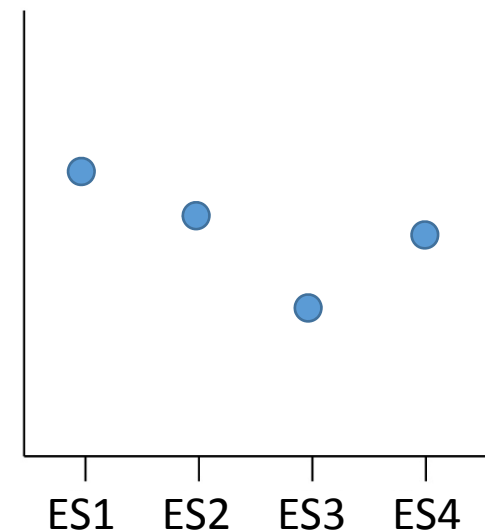
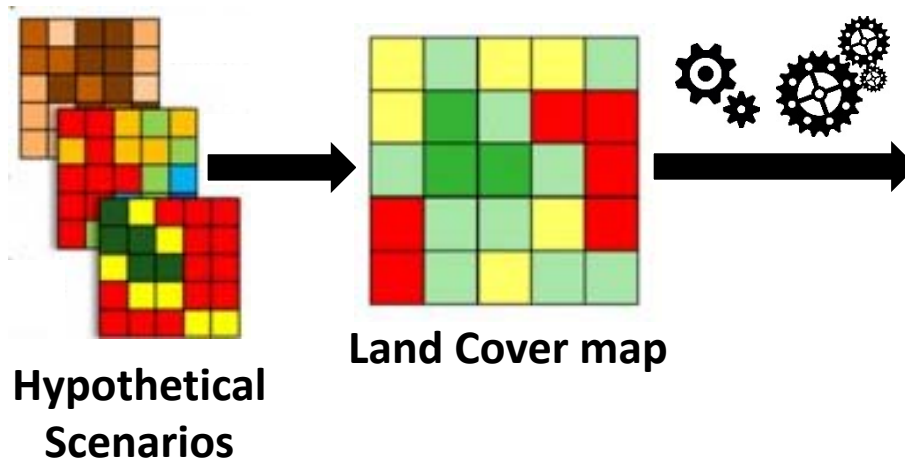
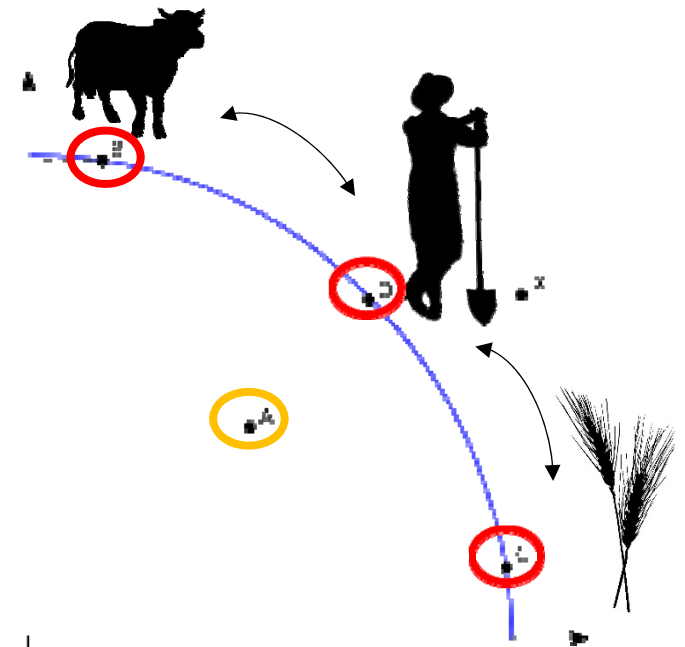


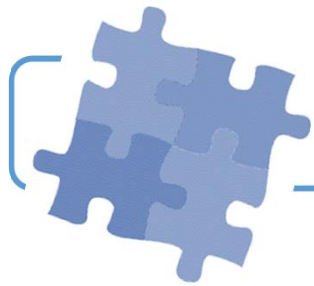


Method 3

Production Frontier

- Production theory in microeconomics
- Describe how to convert an input (ex: land) into various outputs (ex: cropping or cattle farming)
- Production frontier is the set of optimal combination of outputs
- Points below the frontier are sub-optimal

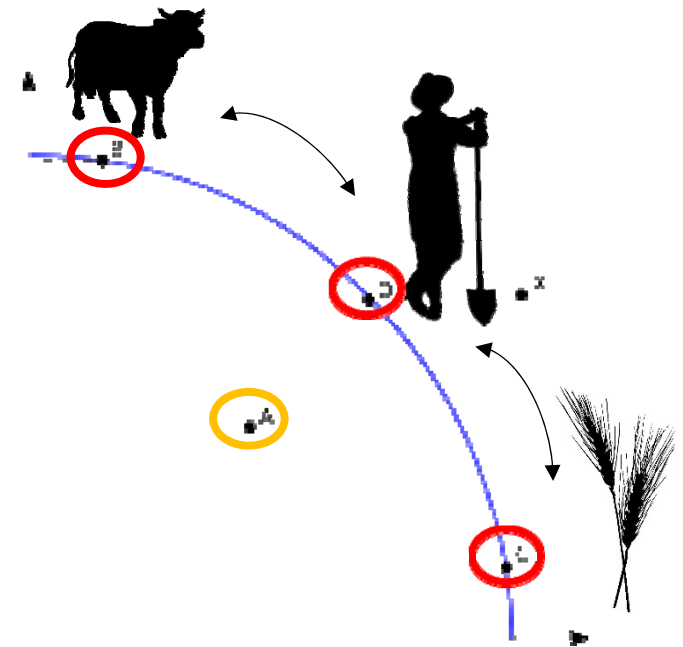




Method 3

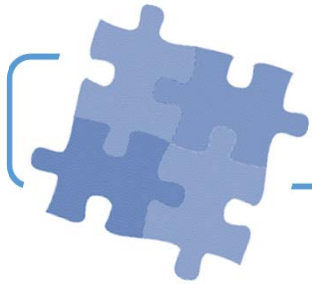
Production Frontier

- Production theory in microeconomics
- Describe how to convert an input (ex: land) into various outputs (ex: cropping or cattle farming)
- Production frontier is the set of optimal combination of outputs
- Points below the frontier are sub-optimal



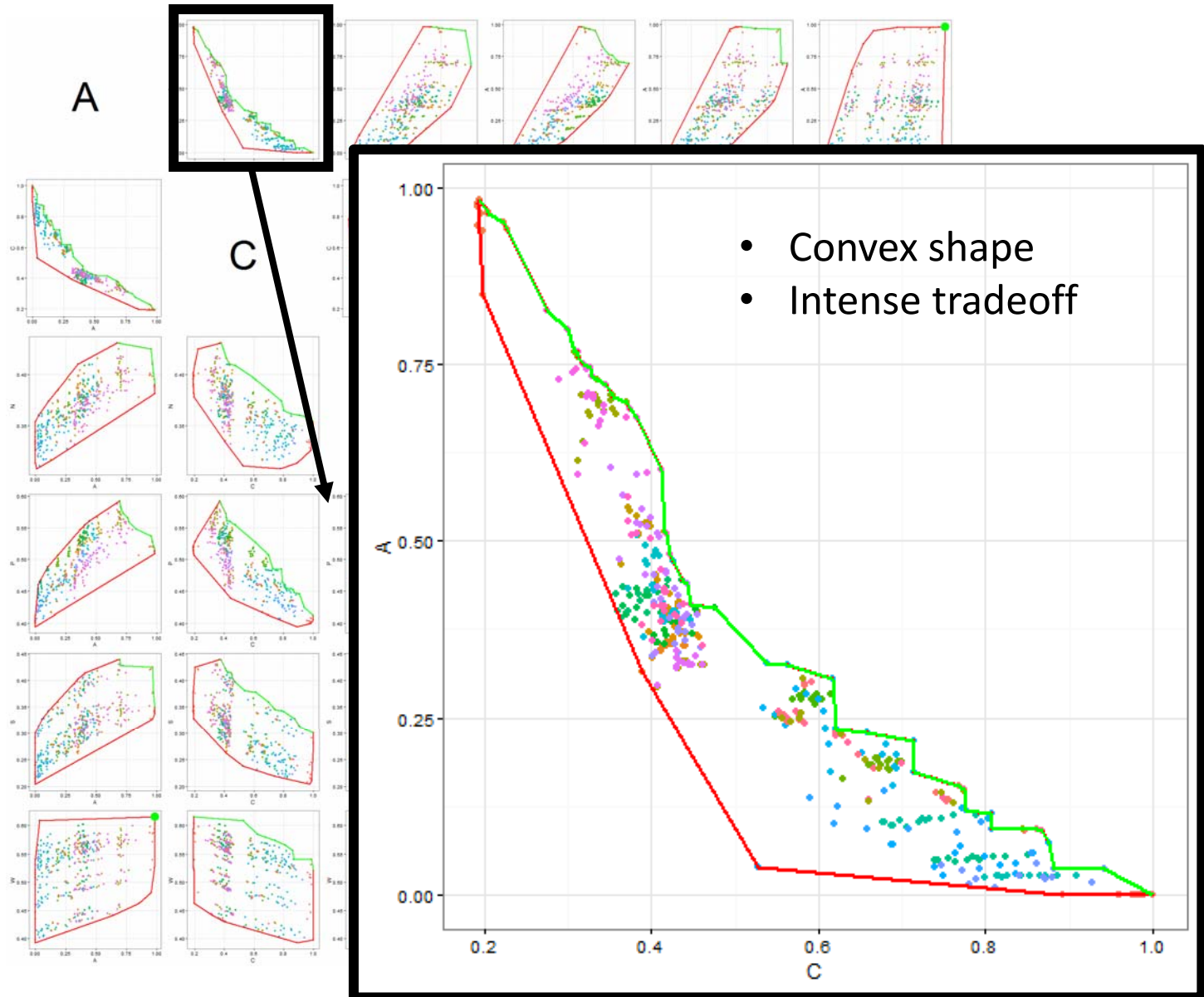
- The shape of the frontier describes the relationship
- Recently increasing attention in literature

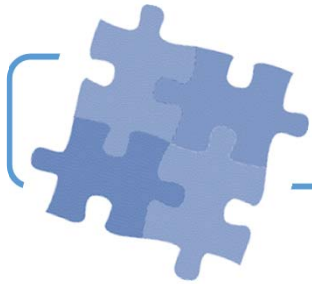
(Bekele et al. 2013; Lester et al. 2013; Kline et al. 2012; Schröter et al. 2014)



Method 3

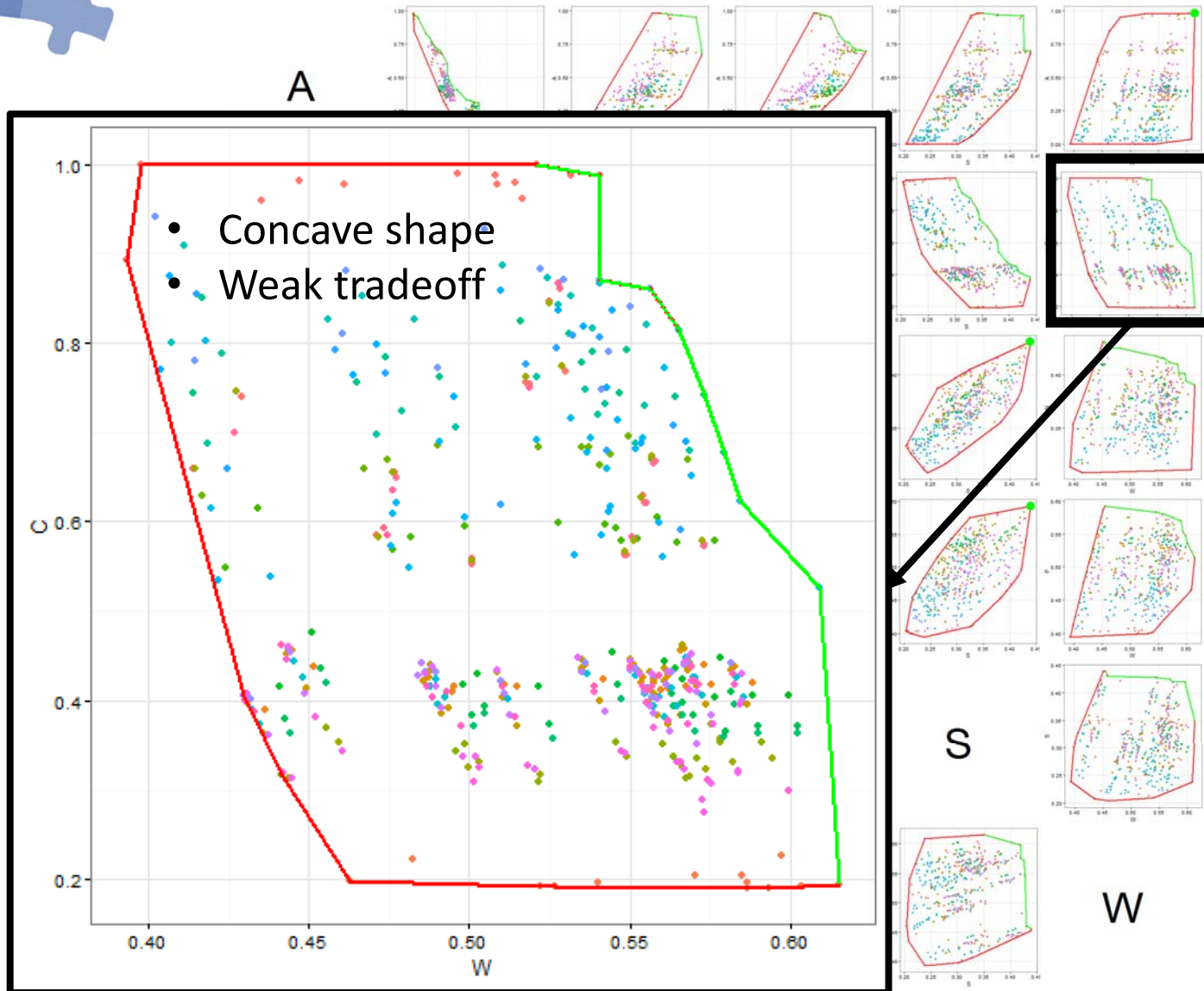
Results and implications

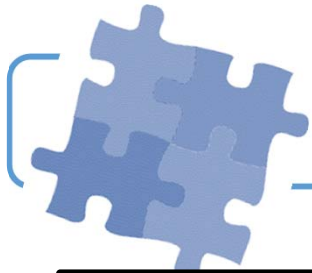




Method 3

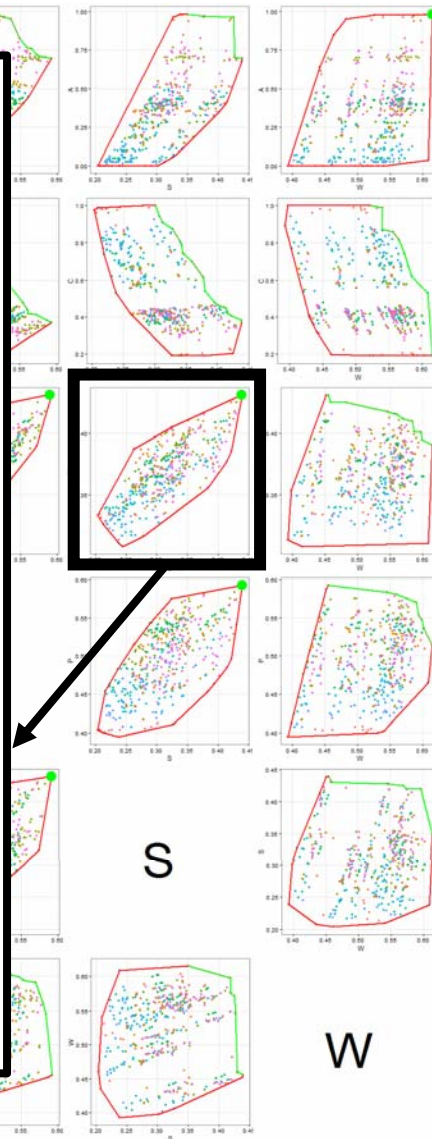
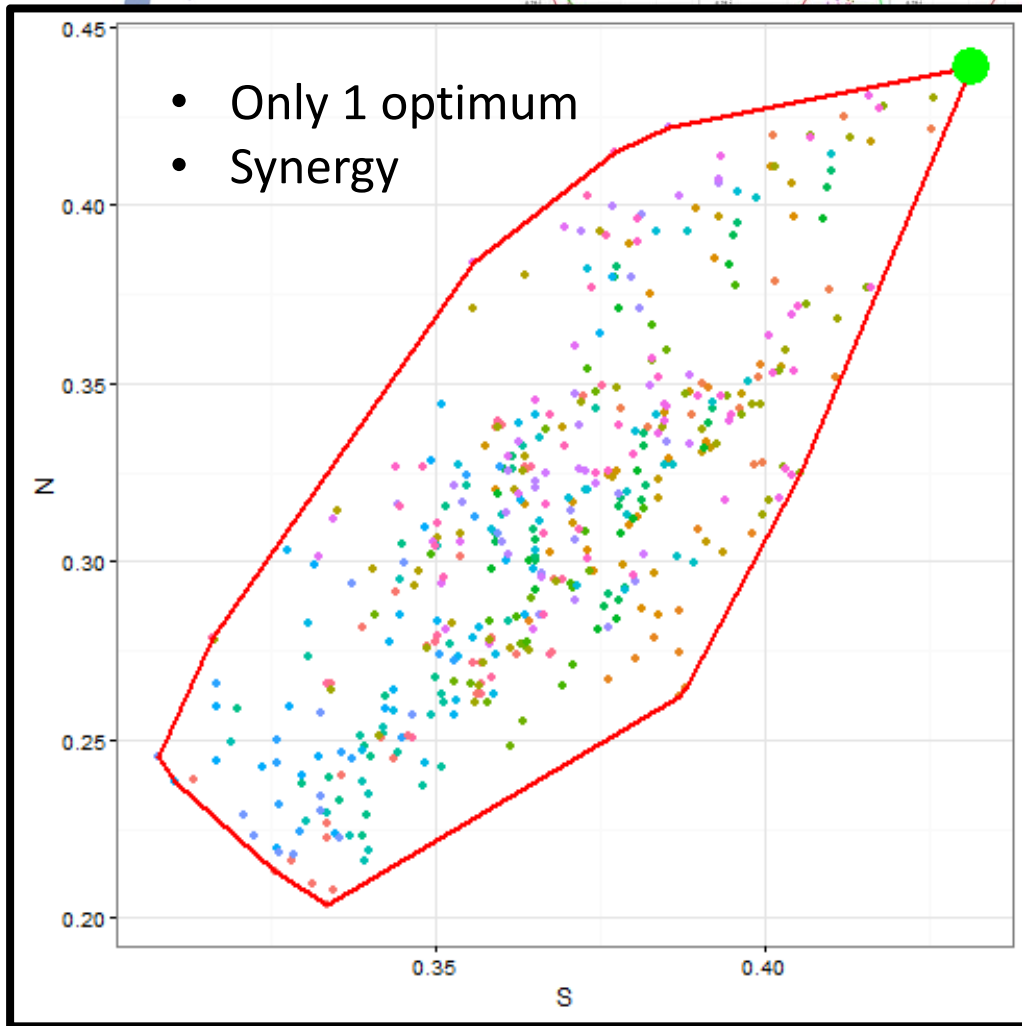
Results and implications

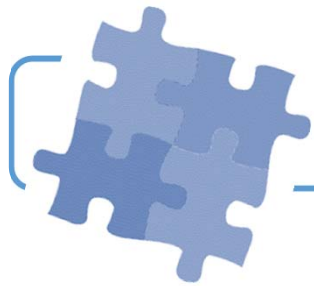




Method 3

Results and implications

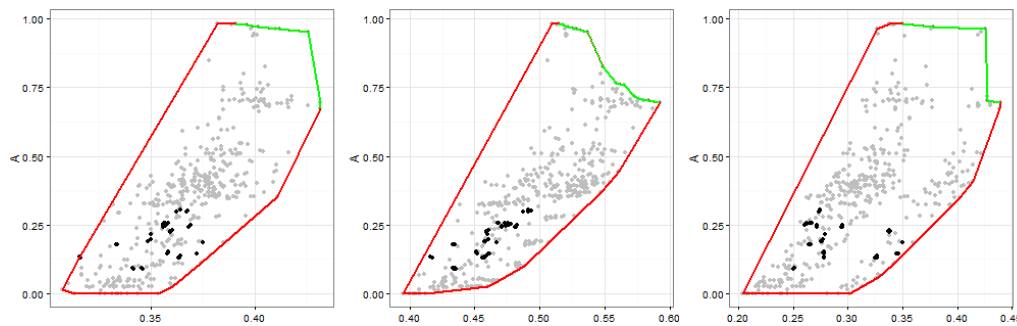




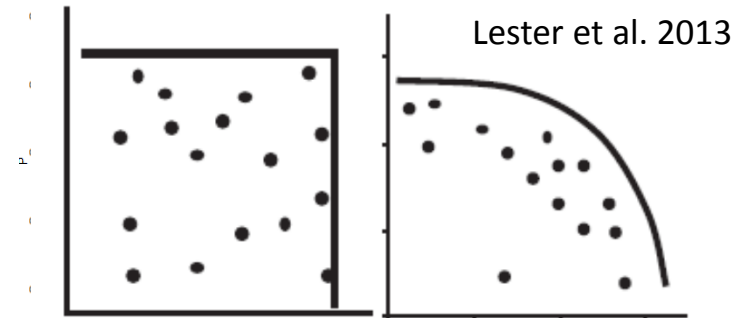
Method 3

Results and implications

- Difficult to compute and interpret
- Actual landscapes are not optimized (social constraints)
- Possibility sets include socially unacceptable situations



Tradeoff or synergy ?

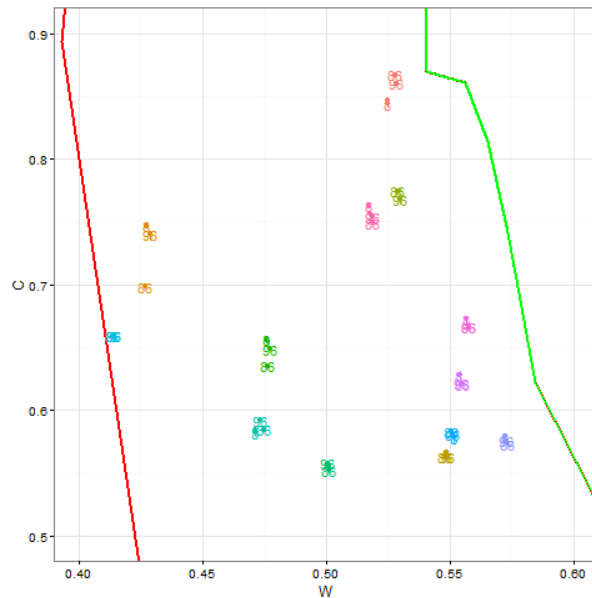


Tradeoff or non-interactive?

- Compare current landscapes and optimum
- Set objectives to orientate landscape planning

Comparison of methods

- Different methods yield different results



- Co-occurrence : No effect
- Co-variation : Synergy
- Production frontier : Tradeoff

- Some incoherence come from difficult interpretation of production frontier shape

So, what should we do ?

- Make explicit the type of tradeoff we are studying and decision context (ES incompatibilities, co-occurrence, co-variation, etc ...) (Turkelboom et al. 2016)
- Dissociate the approach (spatial or temporal explicitness) from the method (correlations, PCA)
- Investigate the mechanisms behind ES tradeoffs (Bennett et al. 2009)
- Look at the broad picture and integrate the populations that are concerned by tradeoffs (Turkelboom et al. 2016)



Thanks for your attention!

**If you have questions or comments on this presentation:
A.Vallet@cgiar.org**



www.centre-cired.fr

www.agroparistech.fr

www.cirad.fr

www.cifor.org

