SUSTAINABILITY ASSESSMENT AND MONITORING

Valentina Giannini

FEEM

Venezia, 24 June 2014

Centro Euro-Mediterraneo sui Cambiamenti Climatici

Project funded by the EUROPEAN UNION

SWIM
SUSTAINABLE WATER INTEGRATED MANAGEMENT

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OUTLINE

- **brief overview of the ACLIMAS project**
- **sustainability analysis**
  - what
  - where
  - how
- **tasks**
  - **task 1** characterization report:
  - **task 2.1** indicator identification & data monitoring
  - **task 2.2** sustainability analysis

ACLIMAS

- **goal**
  - disseminate value of no-till agricultural practices: climate change adaptation
- **beneficiaries**
  - local stakeholders: farmers, water users associations, NGOs, local government extension services
  - local and national decision-makers (incl. governmental research institutions)

→ very important to test eventual uptake of measures at a broader scale

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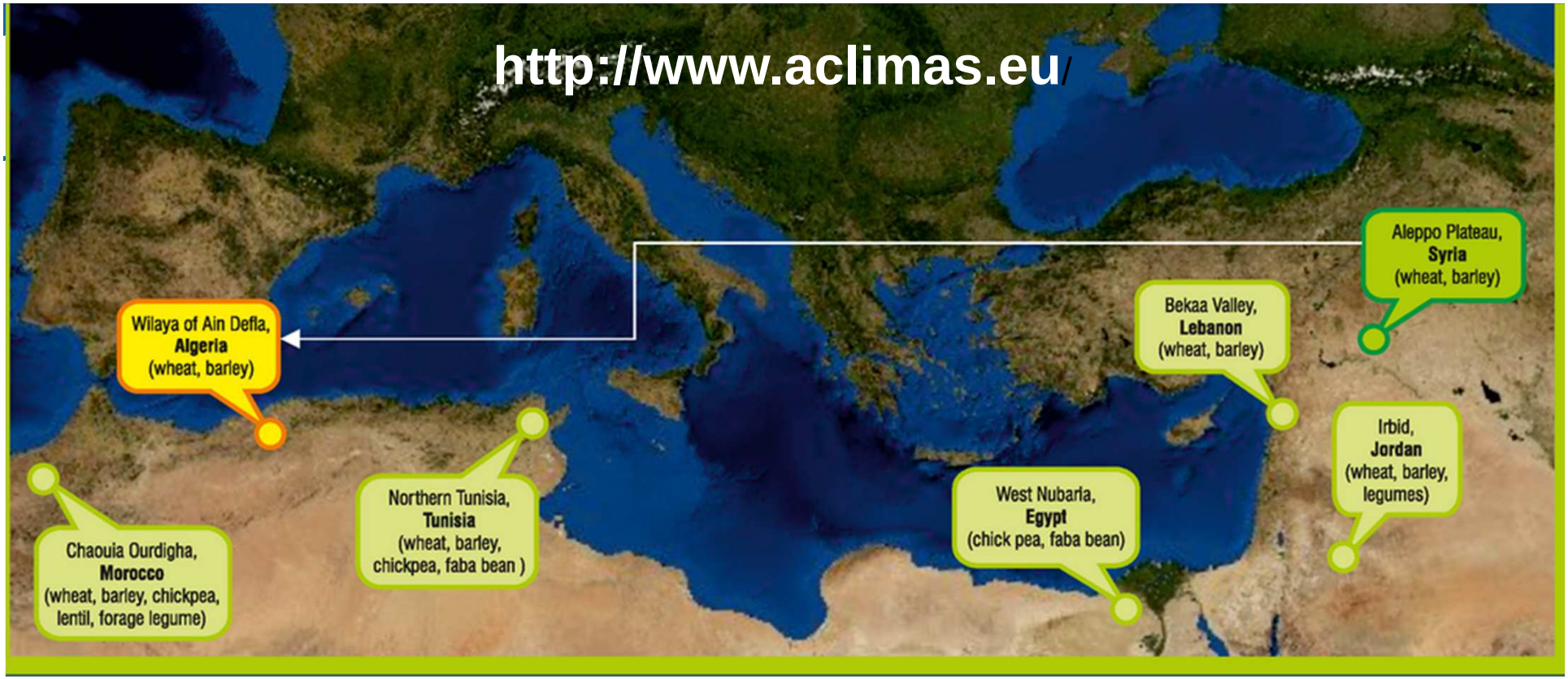


MOROCCO	INRA & AGENDA	UNI LLEIDA	CMCC-CIP
ALGERIA	ICARDA & ITGC	UNI BARCELONA	
(EGYPT)	WNRDP	CMCC-IAFENT	
TUNISIA	INAT	IAMB	IAMB
JORDAN	NCARE	UNI NOTTINGHAM	
LEBANON	LARI & AFIAL	CNR-ISAFOM	

SUSTAINABILITY ANALYSIS

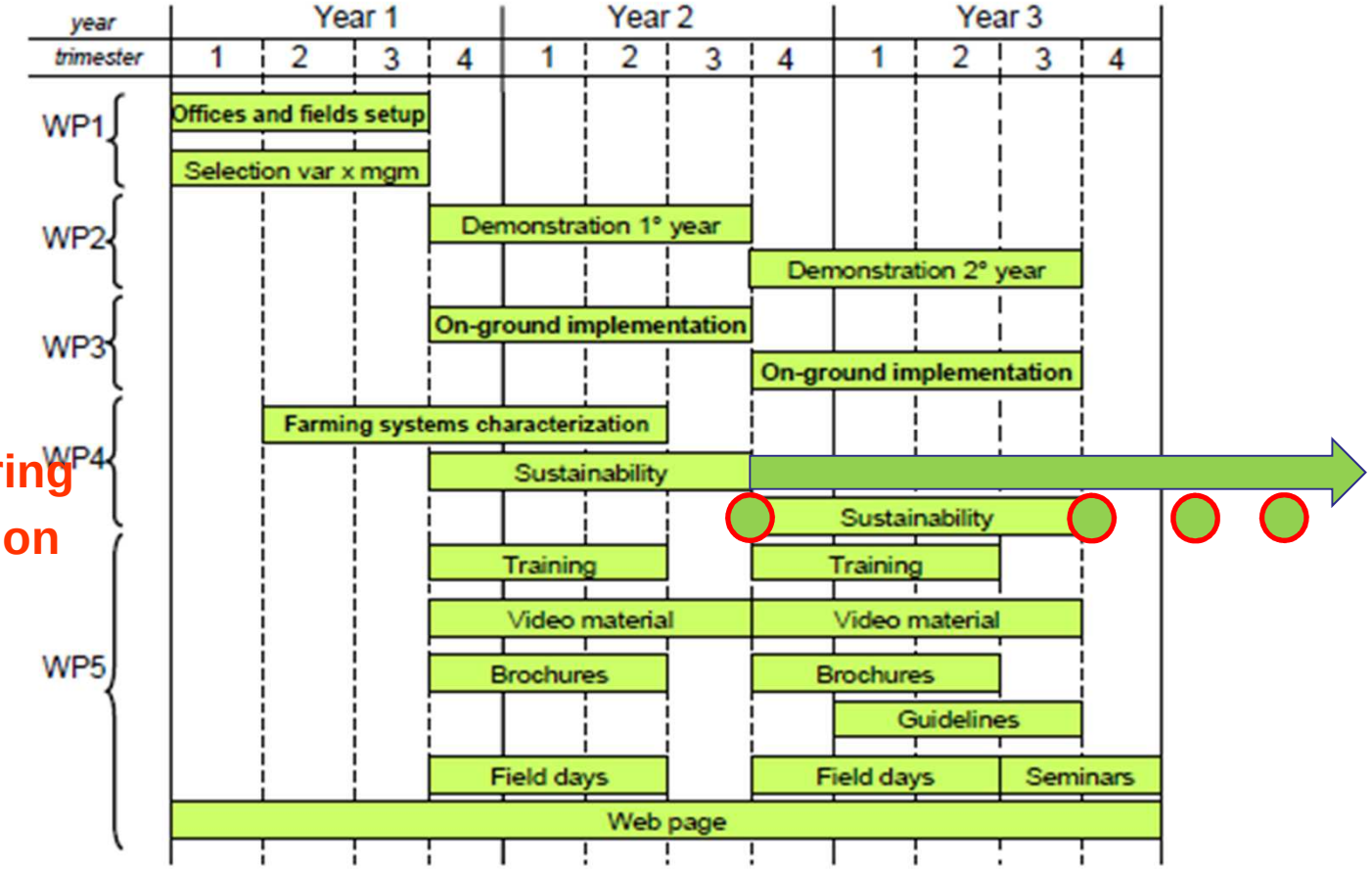
- **WHAT**
  - comparison of existing farming systems with proposed alternative ones, combination of genotypes and agricultural practices (water, fertilizer…)
  - long term perspectives of alternative farming systems
  - trade-offs among environmental, social and economic performances
  - assess robustness of proposed options

- **WHERE**
  - at least one specific or dominant/representative **farming system** per target area in the six Southern Mediterranean countries

- **HOW**
  - **comparison** of existing farming systems with proposed alternative ones, through selected indicators in a participatory multi-criteria decision support system framework
  - scenarios: with and without options; present and future

TASKS

- Task 1 baseline
- Task 2.1 monitoring
- Task 2.2 evaluation



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TASK 1: baseline

Farming systems characterisation

ACTIVITIES:

- Collection of data and documents
- Preparation of desk reports
- One on-site visit per target area
- Selection of farming system/s

DELIVERABLE by M21 (September 2013)

Six reports on the characterization of the selected farming systems, where new genotypes and best management practices will be implemented

TASK 1

- **Collection of data and documents**
  - An Integrated Indicator Table (IIT) has been developed to collect data and to allow a comparison among the case studies for the final analysis of sustainability
  - The IIT for ACLIMAS project is based on initial communication with the involved research partners
  - For each case study, a selection of indicators is identified depending on the specific conditions on the ground and time-series data availability

TASK 1

- **Desk reports**
  - Egypt completed (case study suspended)
  - Morocco completed
  - Algeria completed (Syria case study no longer active)
  - Tunisia completed
  - Jordan completed
  - Lebanon completed

- **On-site visit have been realised in Jordan and Morocco, Lebanon, and Tunisia**
  - Validate the data and information cited in the desk report
  - Collect the missing data
  - Start the elicitation of local stakeholders' objectives

TASK 1

- **Selection of farming system/s based on:**
  - Representativeness for the target area
  - Vulnerability to climate change
  - Willingness to adopt selected varieties and management practices

TASK 1

- **Target area in Morocco: Chaouia**
  - Climate: semi-arid to arid with decreasing rainfall trend, most rain between Sept-May (peak Nov-Jan), avg annual temp 9-26°C (Aug >30°C; Jan <5°C), Chergui hot wind from May
  - Soils: deep black clay 52%; shallow stony 13.3%; shallower soft chalky 17.7%; salty red 16.1%; sandy 0.6%; other 0.4%
  - Water: 4 large dams and 4 collinear dams, small streams and springs; only two aquifers (coastal brackish and Berrechid plain)
  - Policies: wheat subsidies to protect internal production and consumption (50% bread wheat is imported), Green Morocco Plan to develop agricultural potential based on modern agriculture (private investment) and solidarity with smallholders

TASK 1

Description of farming systems in Chaouia

- Wheat belt of Morocco
- Rainfed 96.5%; irrigation mainly for vegetable crops
- Agriculture: cereals 84%, food legumes 4.5%, vegetables (irr) 2.8%
- Livestock: cattle, sheep, goat, aviculture
- Integration between crops and livestock: agricultural by-products are valuable and cheap feed sources for animal production; integration is one of the farmers' strategies to face the risks related to climate changes and markets fluctuations
- Farms size: 54.4% <5ha (=15% land); 38.1% 5-20ha (=45% land); 7.5% >20ha (=40% land);
- Tenure: 78.3% private; 17.7% collective
- Rotations: wheat/ food legumes (→ no rotation), wheat/ barley/ food legumes, wheat/ onion, wheat/ corn, and wheat/ fallow

TASK 2.1: indicators identification & monitoring

MONITORING for Sustainability Analysis

ACTIVITIES:

- Elicitation of local stakeholders' objectives
- Design of the knowledge base
- Selection of indicators (priorities)
- Collection of quantitative data
- Identification of data gaps and solutions (e.g. qualitative data)
- Preliminary qualitative assessment of farming systems and/or scenarios

TASK 2.1

sustainability pillar	main issues discussed	indicators
ECONOMIC: competitiveness of agricultural sector	• agricultural income and its variability • input cost and their availability • competitiveness from surrounding countries	yield stability
		production costs
		farm income
		labour demand
SOCIAL: rural life viability	• social insecurity for farmers and their families • decline in food availability • role of women in agricultural activities	straw availability
		household food security
		access to machinery
ENVIRONMENTAL: natural resources management	• soil erosion problems • water resources scarcity and quality deterioration • agricultural polluters for the environment	soil erosion
		water consumption
		agrochemicals consumption
		diesel consumption

TASK 2.2: sustainability analysis

- **data processing and results**
  - preliminary qualitative results!
    - training workshop March 2014 in Settat:
      27 participants + 9 ACLIMAS
    - qualitative judgement on performance of no-till vs. till:
      18 questionnaires completed
  - definitive quantitative results?
    - three years of data: 2013, 2014, 2015

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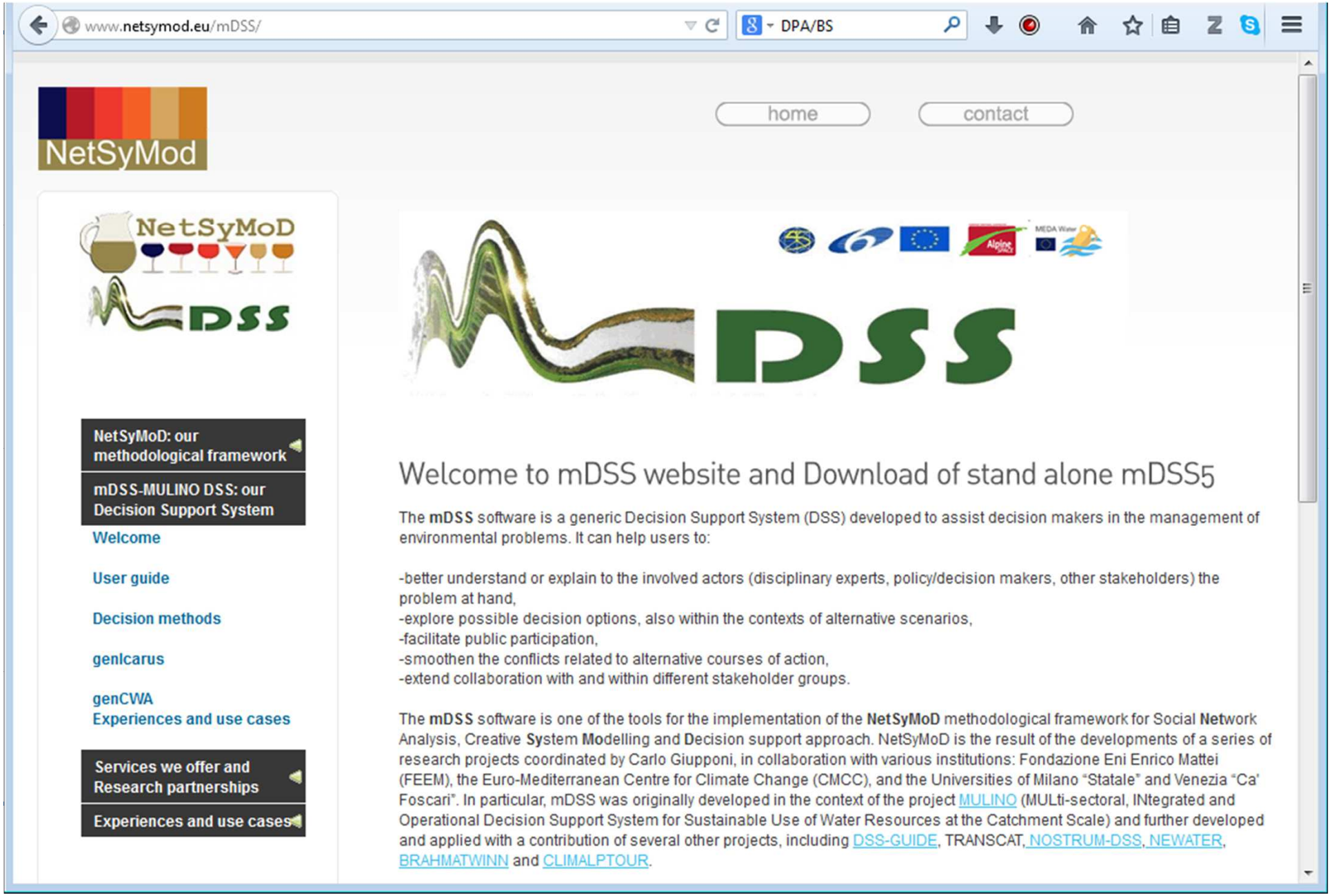
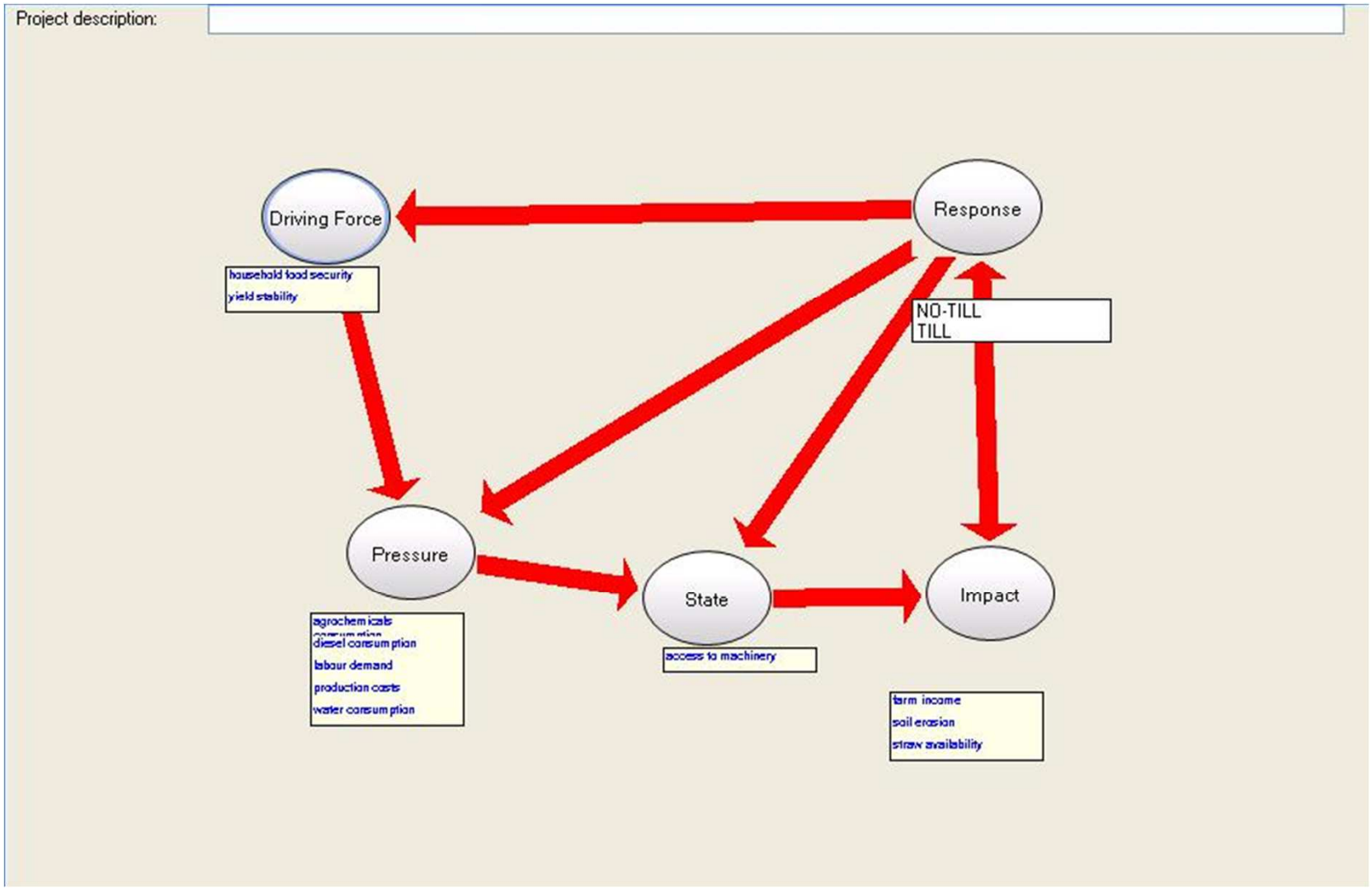
TASK 2.2: training workshop in Settat

TIME		ACTIVITY	WHO
		11-March-2014 DAY 1 **introduction**	
9:00	9:15	Welcome	Hassan Ouabbou, INRA
9:15	10:15	Introduction to ACLIMAS	Mladen Todorovic, IAMB
10:15	10:30	Presentation of agenda	Valentina Giannini, CMCC
10:30	11:00	COFFEE – TEA BREAK	
11:00	11:45	Sustainability analysis and adaptation to climate change	Carlo Giupponi, CMCC
11:45	12:30	Introduction to Decision support systems	Carlo Giupponi, CMCC
12:30	13:00	Sustainability analysis in practice: indicators	Laura Bonzanigo, CMCC
13:00	14:00	LUNCH	
14:00	14:30	Collection of indicators	Laura Bonzanigo, CMCC
14:30	15:15	Demonstration trials	Gustavo Slafer, UNIV. LLEIDA
15:15	15:45	Climate change and agriculture	Antonio Trabucco, CMCC
15:45	16:15	Observed benefits of No-Till	FARMER
16:15	17:00	Data recovery for the selected indicators	Mohamed Boughlala, INRA
		12-March-2014 DAY 2 **mDSS hands-on training**	
9:00	9:30	Introduction to Mulino DSS	Valentina Giannini, CMCC
9:30	10:30	Weighting of the selected indicators	Laura Bonzanigo, CMCC
10:30	11:00	COFFEE – TEA BREAK	
11:00	13:00	Hands-on training: how to monitor sustainability and data input	Giannini & Bonzanigo, CMCC
13:00	14:00	LUNCH	
14:00	16:00	Hands-on training: data input	Giannini & Bonzanigo, CMCC
16:00	17:00	Final discussion and comments	all
		13-March-2014 DAY 3 **field day**	
8:00	13:00	programme to be defined by INRA & Agenda	all
14:00	17:00	time to complete data collection	Giannini & Bonzanigo, CMCC Mohamed Boughlala, INRA

TASK 2.2: mDSS


www.netsymod.eu/mDSS/
DPA/BS
NetSyMod
home
contact
NetSyMoD
DSS
NetSyMoD: our methodological framework
mDSS-MULINO DSS: our Decision Support System
Welcome
User guide
Decision methods
genIcarus
genCWA
Experiences and use cases
Services we offer and Research partnerships
Experiences and use cases
DSS
Welcome to mDSS website and Download of stand alone mDSS5
The mDSS software is a generic Decision Support System (DSS) developed to assist decision makers in the management of environmental problems. It can help users to:
-better understand or explain to the involved actors (disciplinary experts, policy/decision makers, other stakeholders) the problem at hand,
-explore possible decision options, also within the contexts of alternative scenarios,
-facilitate public participation,
-smoothen the conflicts related to alternative courses of action,
-extend collaboration with and within different stakeholder groups.
The mDSS software is one of the tools for the implementation of the NetSyMoD methodological framework for Social Network Analysis, Creative System Modelling and Decision support approach. NetSyMoD is the result of the developments of a series of research projects coordinated by Carlo Giupponi, in collaboration with various institutions: Fondazione Eni Enrico Mattei (FEEM), the Euro-Mediterranean Centre for Climate Change (CMCC), and the Universities of Milano "Statale" and Venezia "Ca' Foscari". In particular, mDSS was originally developed in the context of the project MULINO (MULti-sectoral, INtegrated and Operational Decision Support System for Sustainable Use of Water Resources at the Catchment Scale) and further developed and applied with a contribution of several other projects, including DSS-GUIDE, TRANSCAT, NOSTRUM-DSS, NEWATER, BRAHMATWINN and CLIMALPTOUR.

TASK 2.2: data processing



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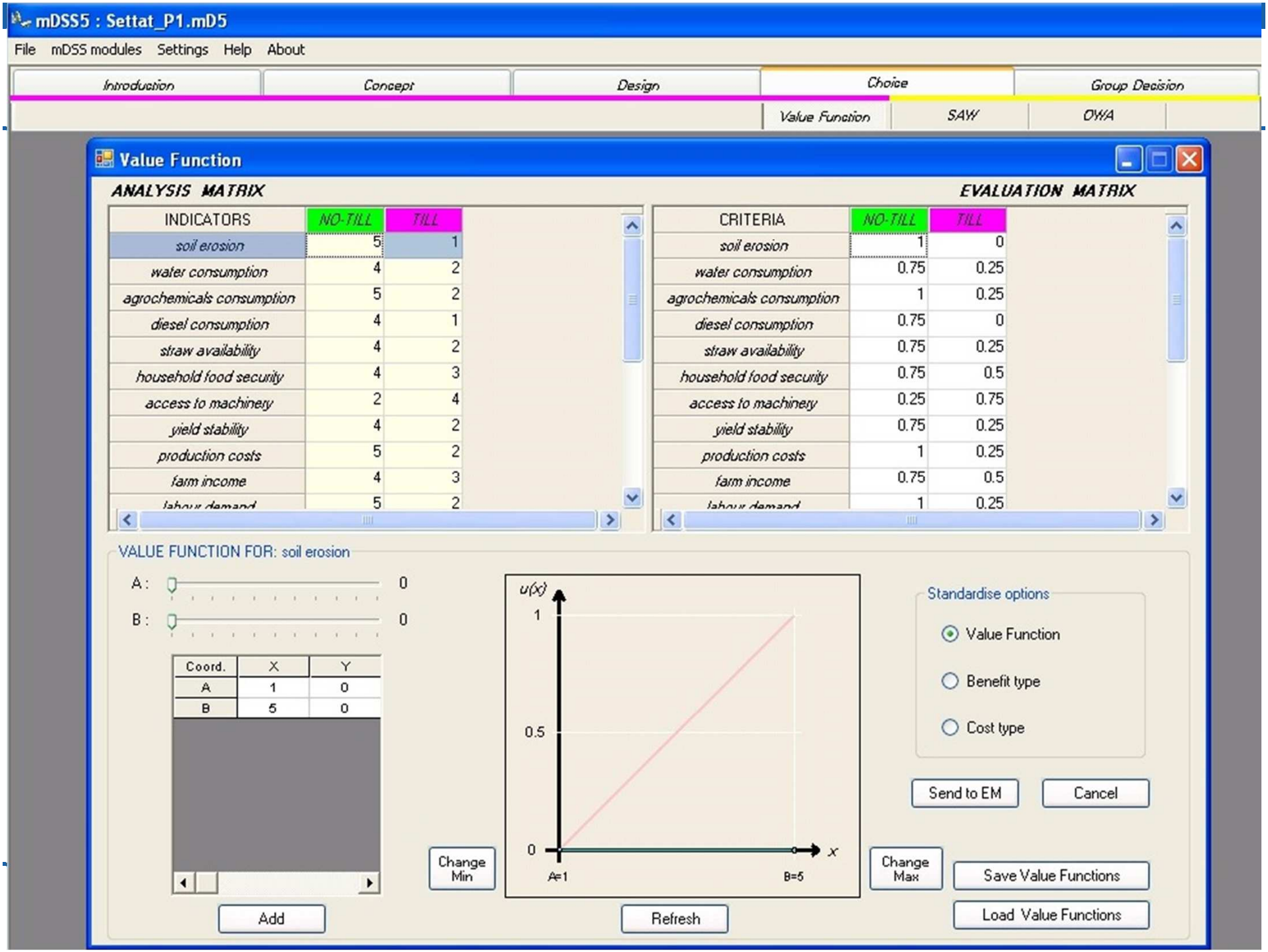
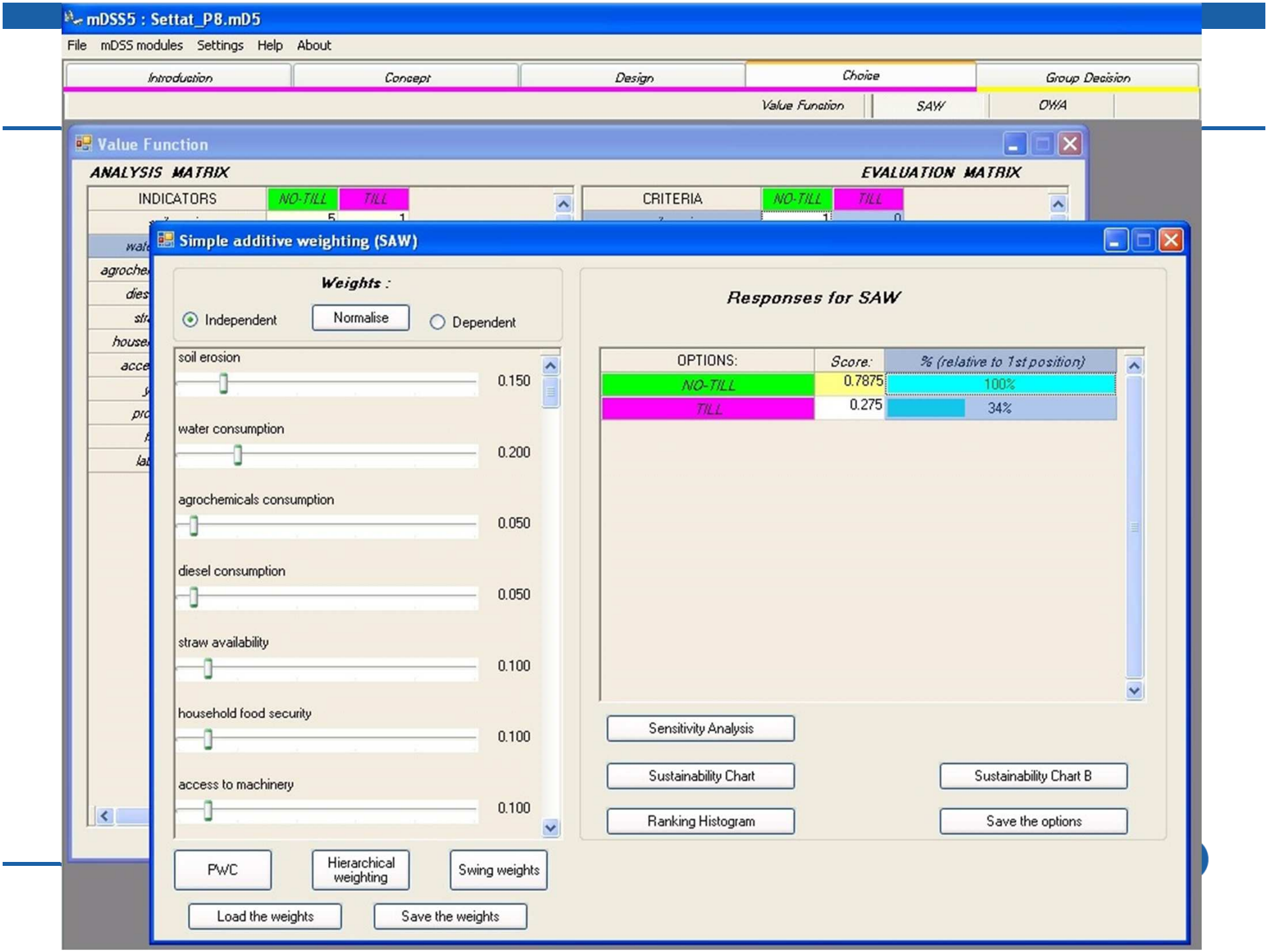
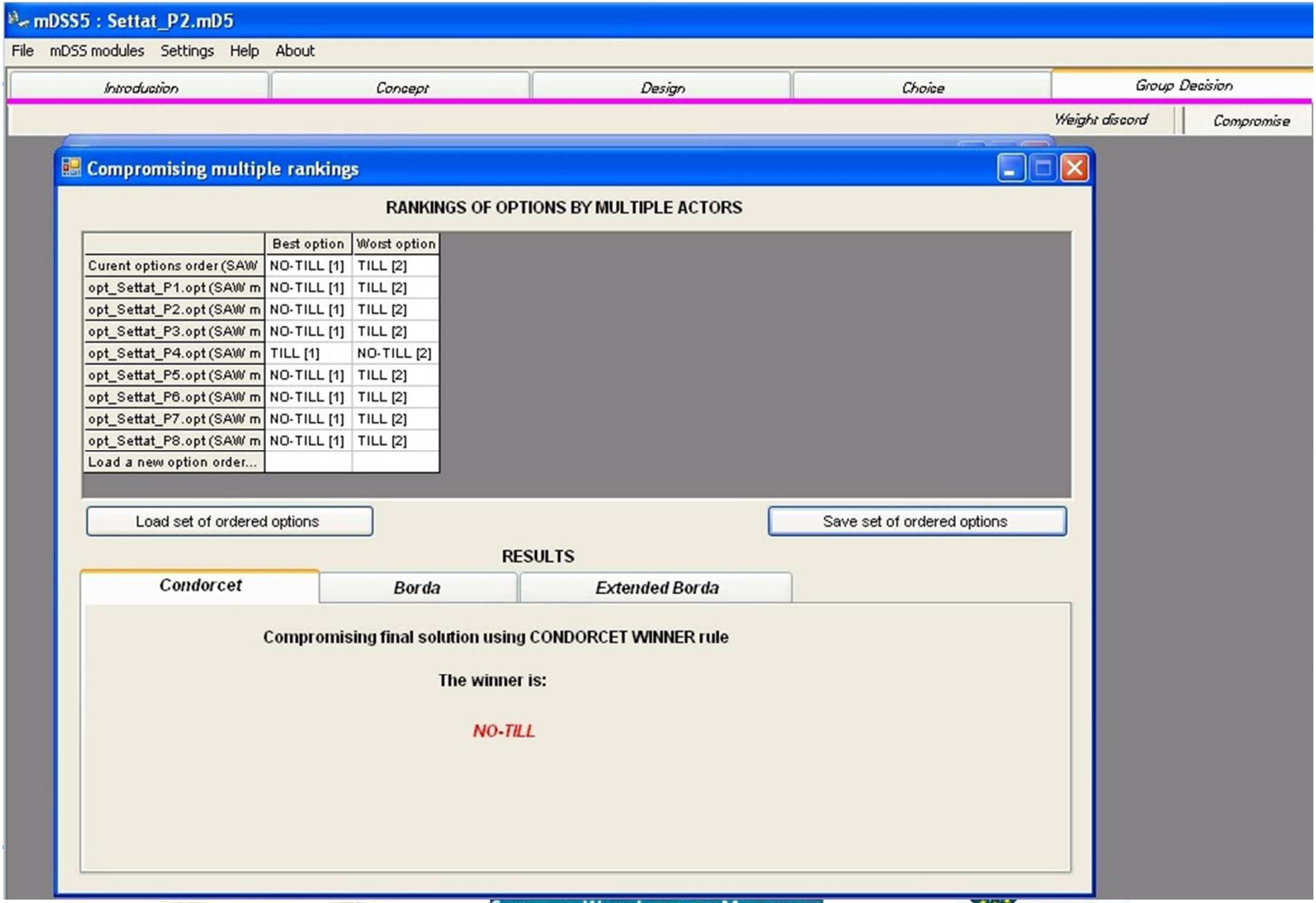
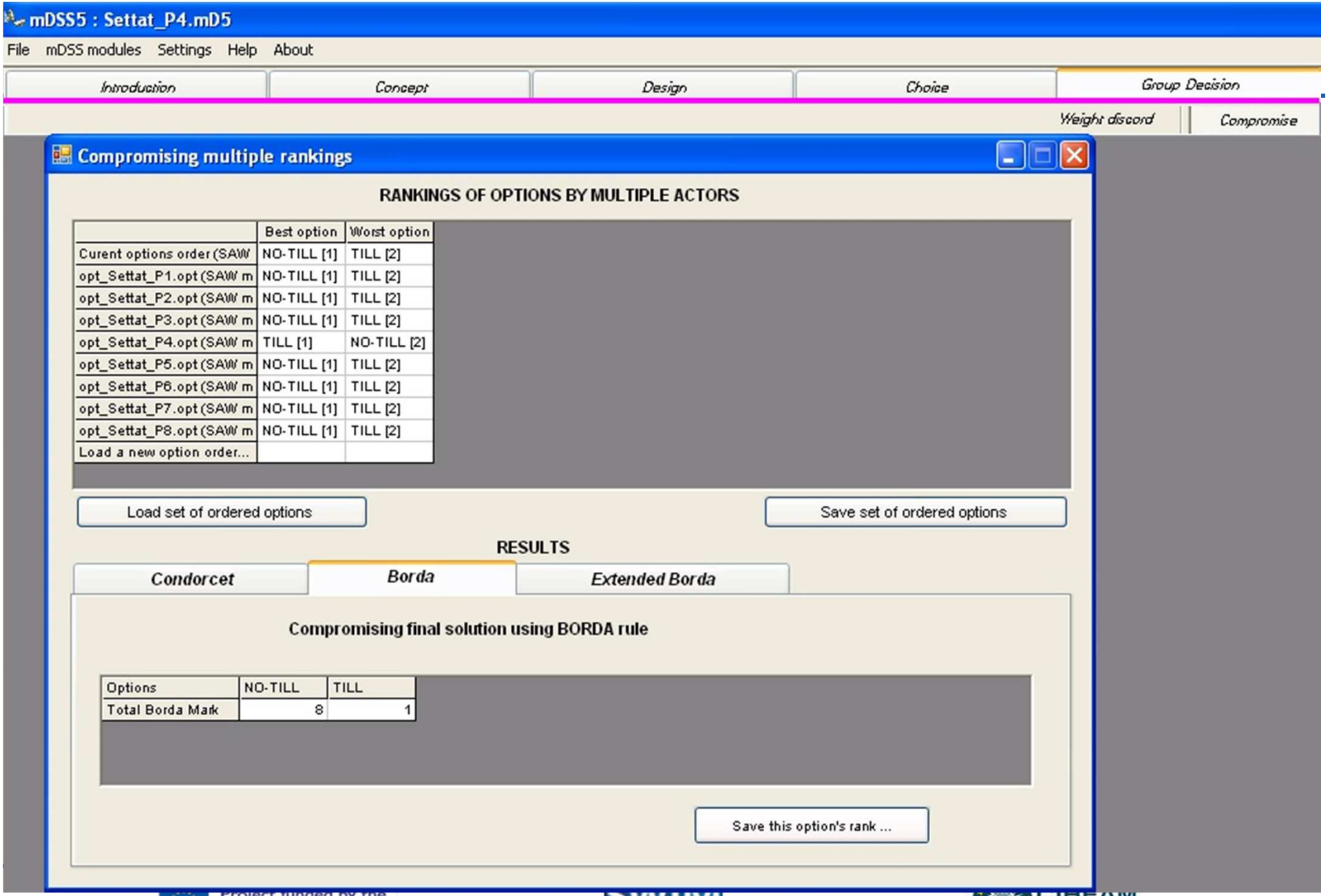
TASK 2.2

INDICATORS	Constraint	NO-TILL	TILL
soil erosion		5	1
water consumption		4	2
agrochemicals consumption		5	2
diesel consumption		4	1
straw availability		4	2
household food security		4	3
access to machinery		2	4
yield stability		4	2
production costs		5	2
farm income		4	3
labour demand		5	2


mDSS5 : Settat_P1.mD5
File
mDSS modules
Settings
Help
About
Introduction
Concept
Design
Choice
Group Decision
Value Function
SAW
OWA
Value Function
ANALYSIS MATRIX
INDICATORS
NO-TILL
TILL
soil erosion 5 1
water consumption 4 2
agrochemicals consumption 5 2
diesel consumption 4 1
straw availability 4 2
household food security 4 3
access to machinery 2 4
yield stability 4 2
production costs 5 2
farm income 4 3
labour demand 5 2
EVALUATION MATRIX
CRITERIA
NO-TILL
TILL
soil erosion 1 0
water consumption 0.75 0.25
agrochemicals consumption 1 0.25
diesel consumption 0.75 0
straw availability 0.75 0.25
household food security 0.75 0.5
access to machinery 0.25 0.75
yield stability 0.75 0.25
production costs 1 0.25
farm income 0.75 0.5
labour demand 1 0.25
VALUE FUNCTION FOR: soil erosion
A : 0
B : 0
Coord. X Y
A 1 0
B 5 0
Add
u(x)
1
0.5
0
x
A=1
B=5
Change Min
Refresh
Change Max
Standardise options
Value Function
Benefit type
Cost type
Send to EM
Cancel
Save Value Functions
Load Value Functions

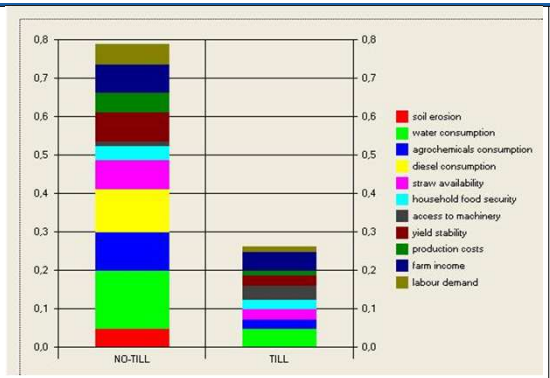

mDSS5 : Settat_P8.mD5
File
mDSS modules
Settings
Help
About
Introduction
Concept
Design
Choice
Group Decision
Value Function
SAW
OWA
Value Function
ANALYSIS MATRIX
EVALUATION MATRIX
INDICATORS
NO-TILL
TILL
CRITERIA
Simple additive weighting (SAW)
Weights :
Independent
Normalise
Dependent
soil erosion
0.150
water consumption
0.200
agrochemicals consumption
0.050
diesel consumption
0.050
straw availability
0.100
household food security
0.100
access to machinery
0.100
PWC
Hierarchical weighting
Swing weights
Load the weights
Save the weights
Responses for SAW
OPTIONS:
Score:
% (relative to 1st position)
NO-TILL
0.7875
100%
TILL
0.275
34%
Sensitivity Analysis
Sustainability Chart
Sustainability Chart B
Ranking Histogram
Save the options


mDSS5 : Settat_P2.mD5
File
mDSS modules
Settings
Help
About
Introduction
Concept
Design
Choice
Group Decision
Weight discord
Compromise
Compromising multiple rankings
RANKINGS OF OPTIONS BY MULTIPLE ACTORS
Best option
Worst option
Curent options order (SAW
NO-TILL [1]
TILL [2]
opt_Settat_P1.opt (SAW m
NO-TILL [1]
TILL [2]
opt_Settat_P2.opt (SAW m
NO-TILL [1]
TILL [2]
opt_Settat_P3.opt (SAW m
NO-TILL [1]
TILL [2]
opt_Settat_P4.opt (SAW m
TILL [1]
NO-TILL [2]
opt_Settat_P5.opt (SAW m
NO-TILL [1]
TILL [2]
opt_Settat_P6.opt (SAW m
NO-TILL [1]
TILL [2]
opt_Settat_P7.opt (SAW m
NO-TILL [1]
TILL [2]
opt_Settat_P8.opt (SAW m
NO-TILL [1]
TILL [2]
Load a new option order...
Load set of ordered options
Save set of ordered options
RESULTS
Condorcet
Borda
Extended Borda
Compromising final solution using CONDORCET WINNER rule
The winner is:
NO-TILL



TASK 2.2: ranking histogram

P1



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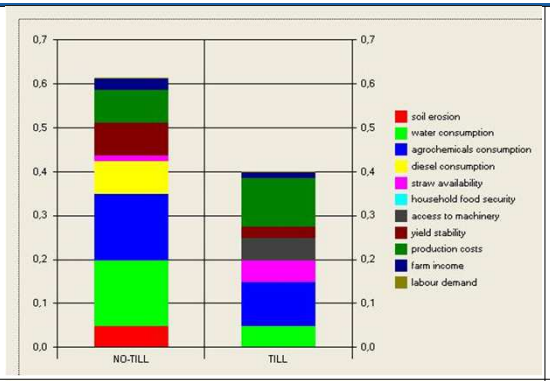

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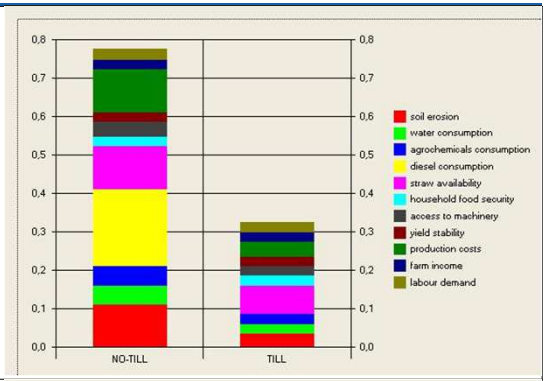

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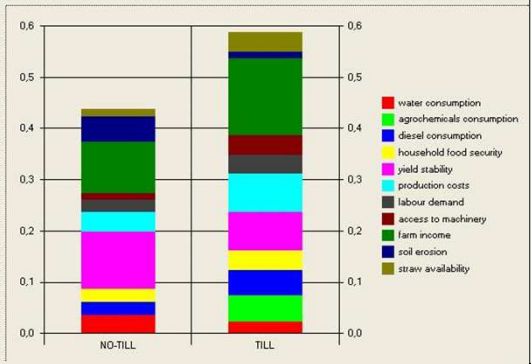

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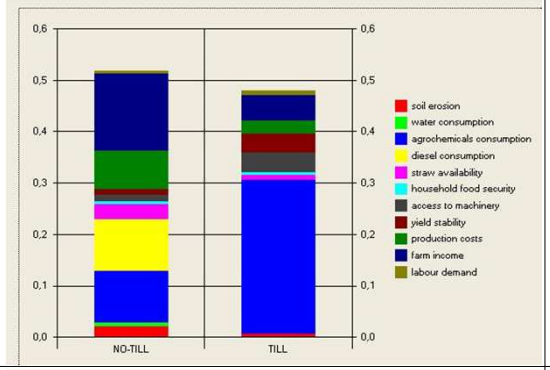

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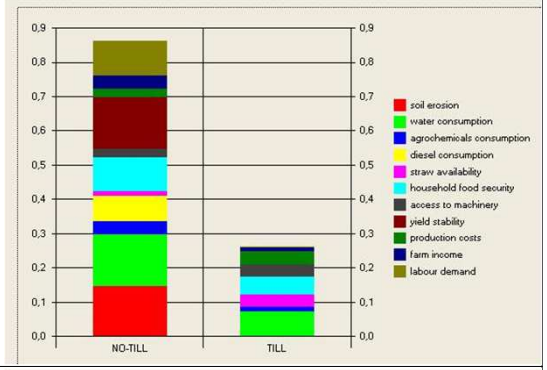

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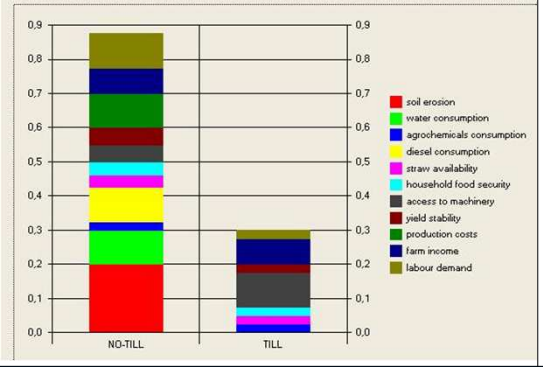

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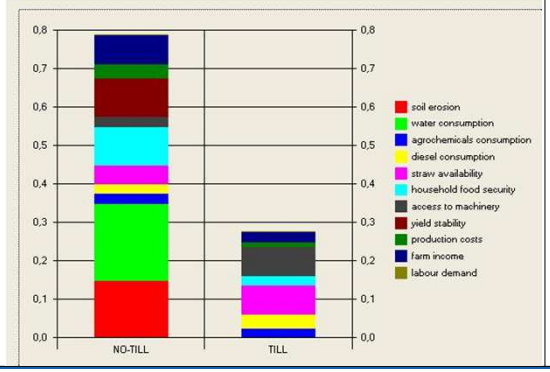
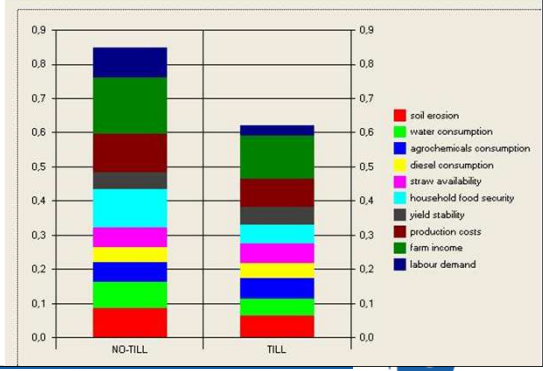


P9



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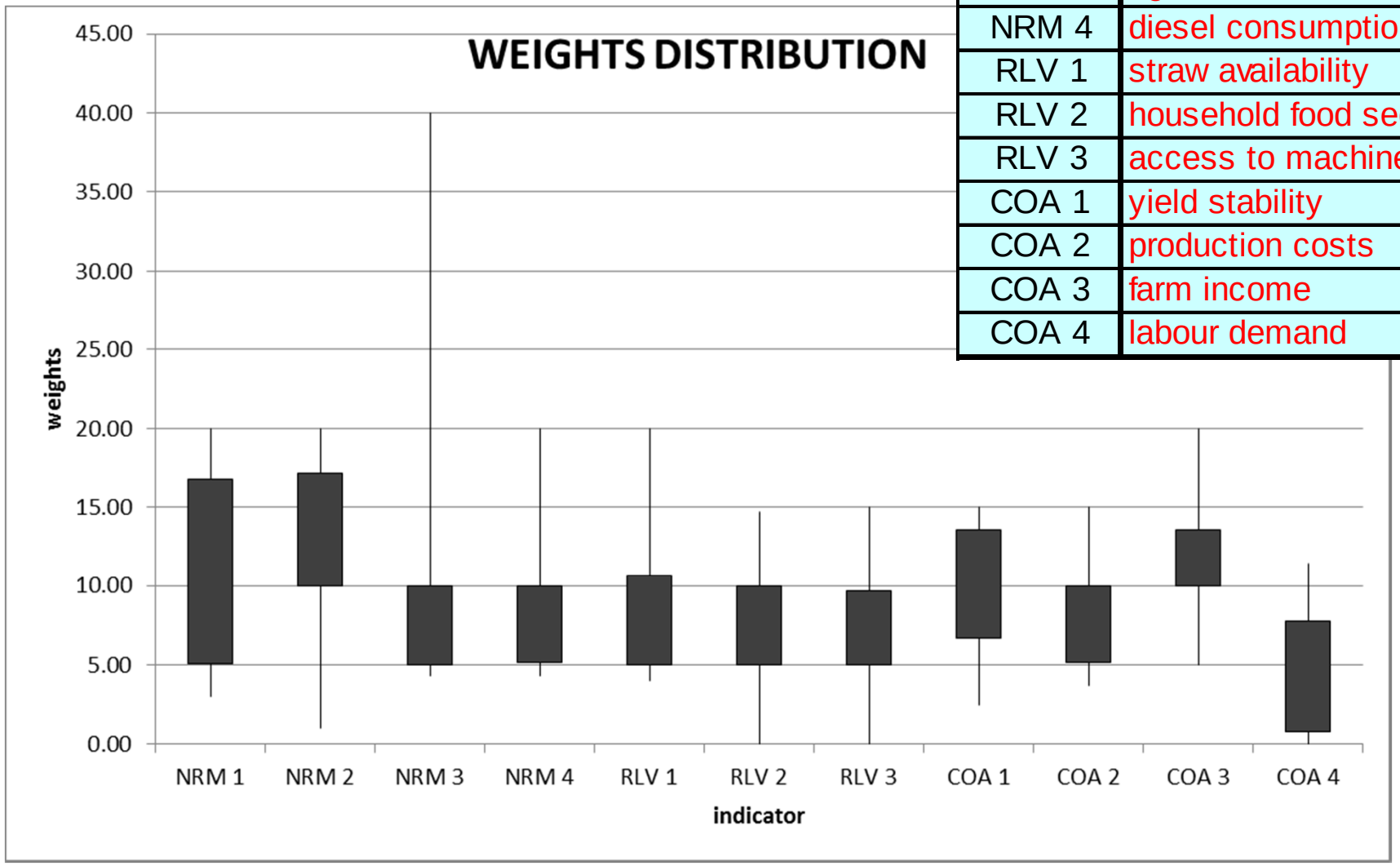
TASK 2

NRM 1	soil erosion
NRM 2	water consumption
NRM 3	agrochemicals consum
NRM 4	diesel consumption
RLV 1	straw availability
RLV 2	household food security
RLV 3	access to machinery
COA 1	yield stability
COA 2	production costs
COA 3	farm income
COA 4	labour demand



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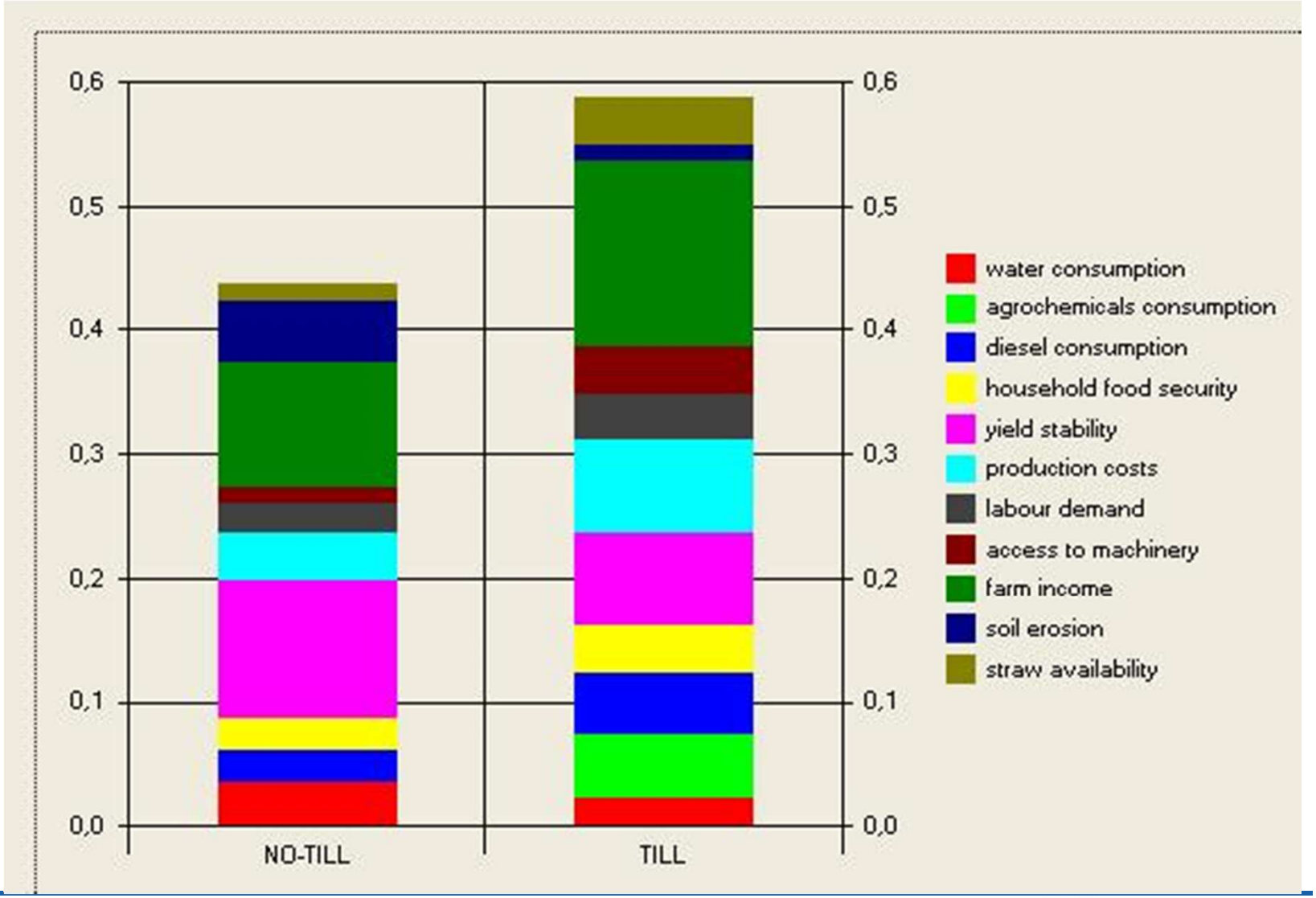
TASK 2.2: ranking histogram



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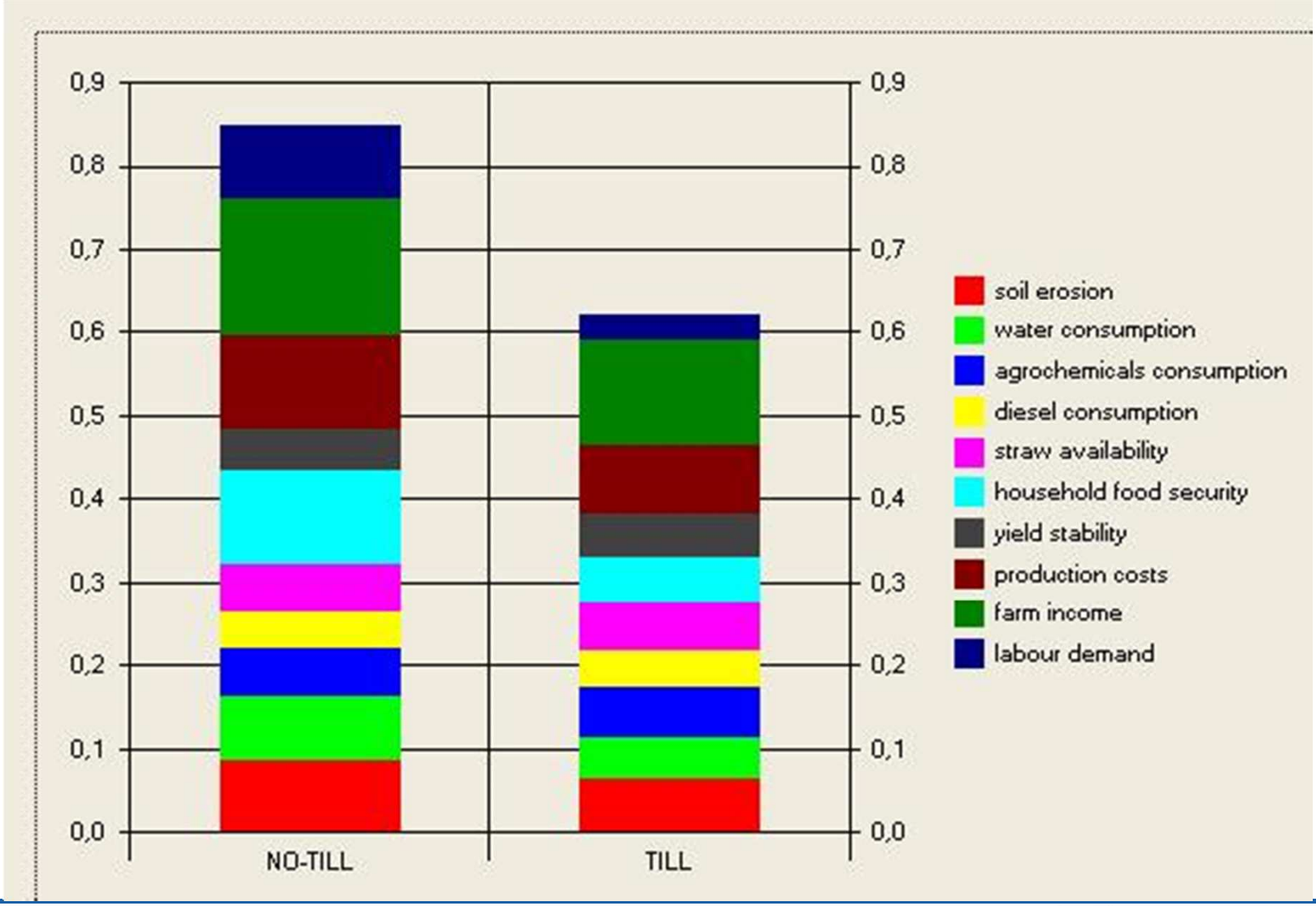

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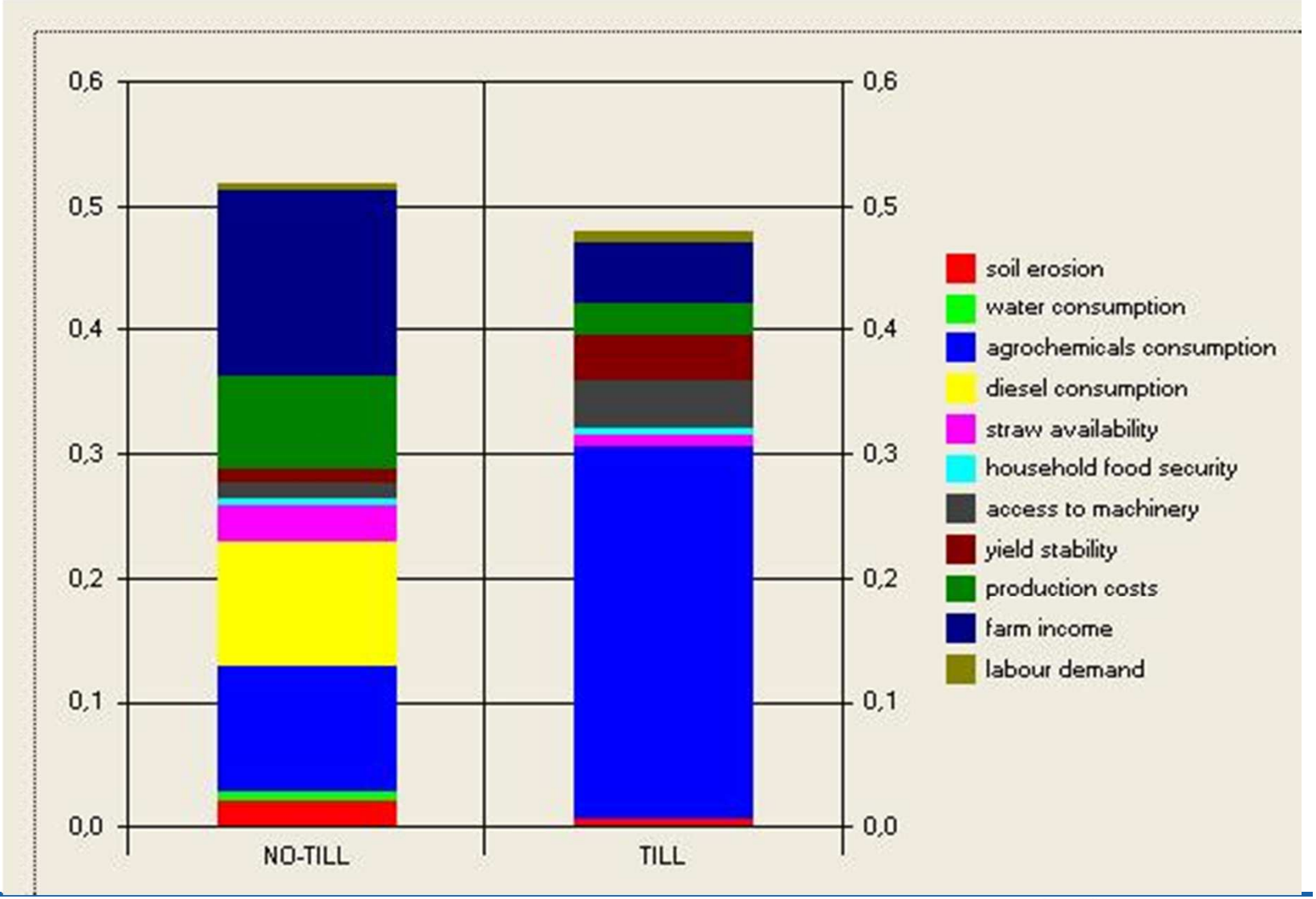
TASK 2: ranking histogram



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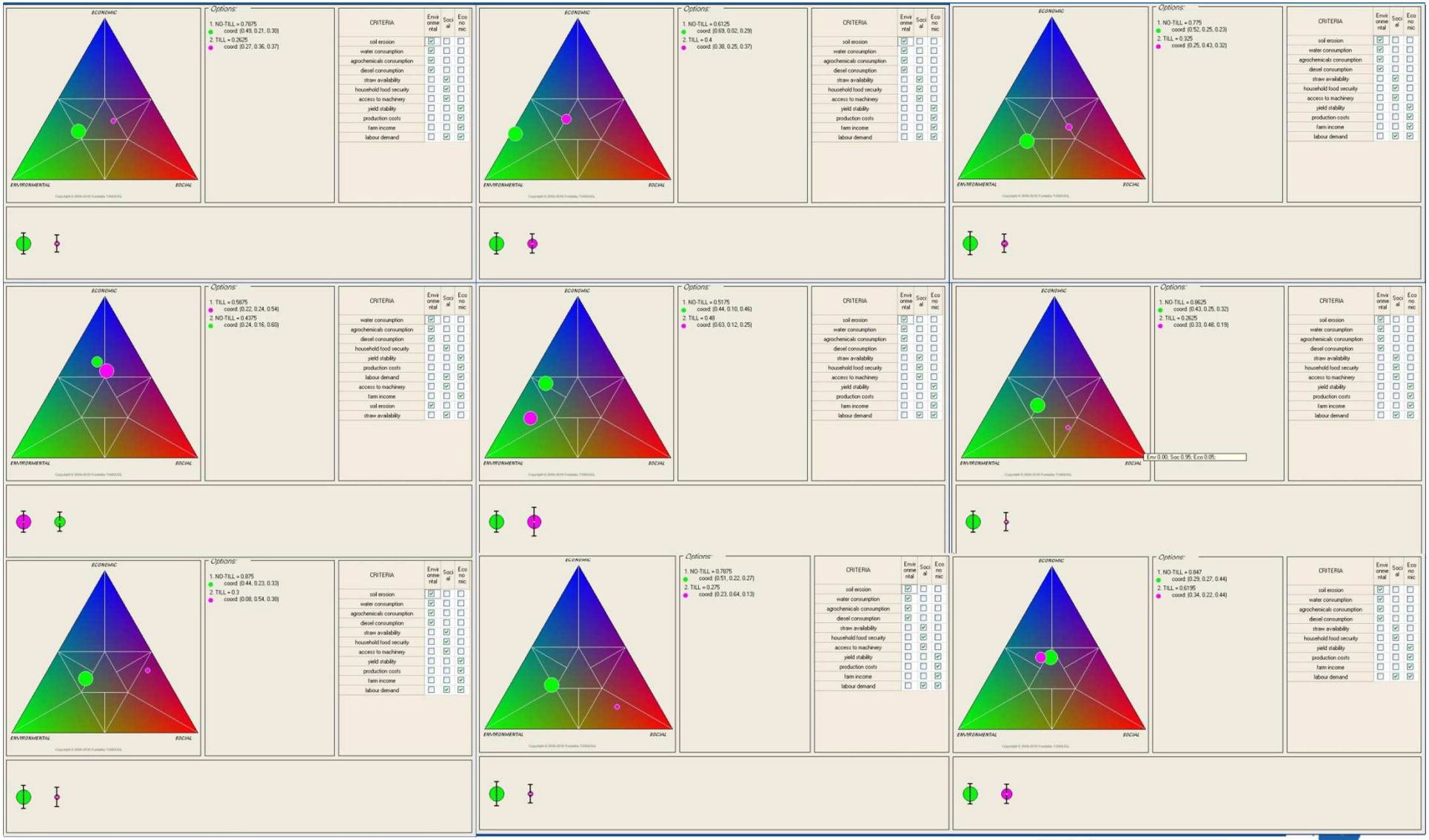
TASK 2: sustainability chart



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NEXT STEPS

- **Collection of quantitative data 2013, 2014, 2015**
- Sustainability assessment and monitoring: trend
- Cross-case assessment


http://www.netsymod.eu/mDSS/
THANK YOU!
aclimas@cmcc.it
valentina.giannini@cmcc.it