



SUSTAINING FORESTS, SUSTAINING PEOPLE
THE ROLE OF RESEARCH



University of Natural Resources
and Life Sciences, Vienna
Department of Forest and Soil
Sciences

Community of Practice of Forest Management Decision Support Systems and Lessons Learned for DSS Development and Application

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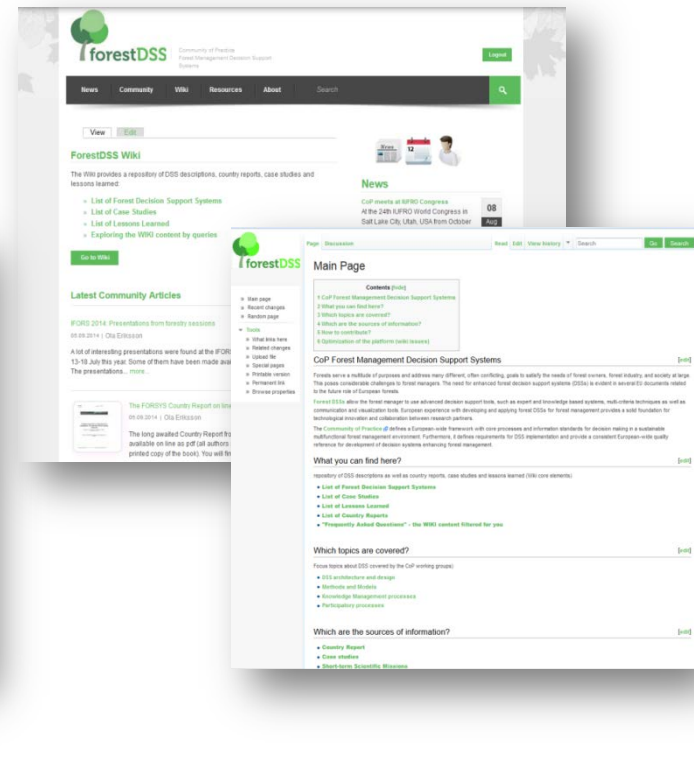
University of Natural Resources and Life Sciences (BOKU) Vienna, Austria, EUROPE
Portland State University, Portland, Oregon, US

**Session: Providing Ecosystem Services under Climate Change -
Community of Practice of Forest Decision Support Systems**

Overview



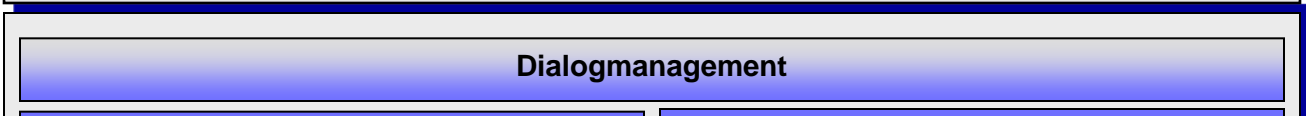
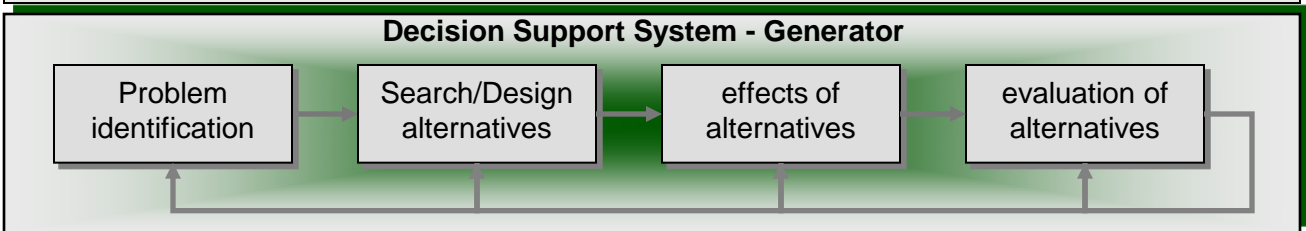
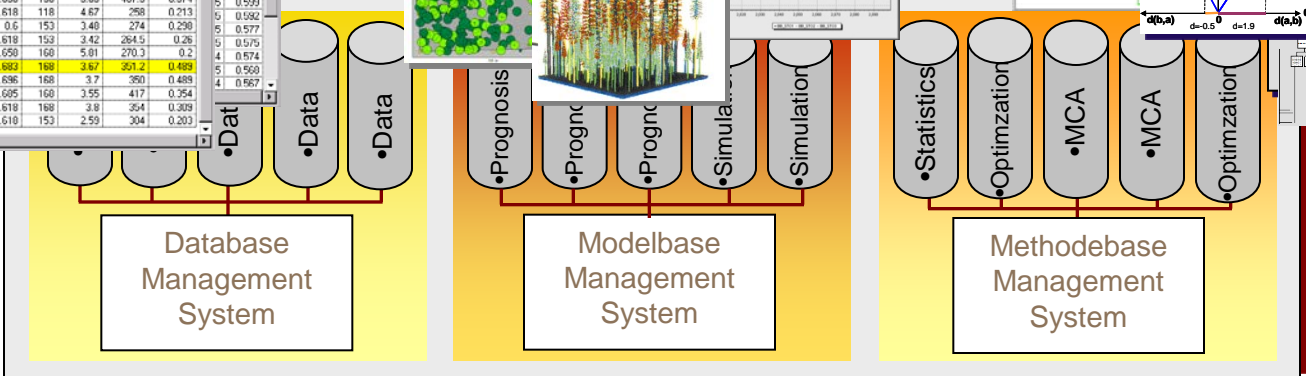
- Introduction to Decision Support Systems and CoP
- Requirements for DSS providing ES under CC
- Example AFM Tool Box
- Conclusions



Koer	genotyp	RM	GSD	Linn	Eigen	Lebens	gen	alte_pos	skalare	GSD
10a4	1101	3	2	0.664	0.597	0.610	160	3.93	421.5	0.695
12b7	1101	3	9	0.664	0.654	0.659	138	5.63	407.5	0.374
12c5	1101	3	2	0.664	0.667	0.618	118	4.87	298	0.213
12d2	1101	5	2	0.619	0.597	0.6	153	3.49	274	0.290
12e2	1101	3	2	0.664	0.597	0.618	153	3.42	264.5	0.26
13c3	1101	3	9	0.664	0.654	0.650	160	5.81	270.3	0.2
13d4	1101	7	5	0.68	0.685	0.683	168	3.67	351.2	0.489
13e1	1101	3	8	0.664	0.717	0.636	168	3.7	360	0.489
13e1	1101	3	8	0.664	0.695	0.68	168	3.9	354	0.309
13e2	1101	3	8	0.664	0.697	0.618	168	3.9	354	0.309
13e3	1101	3	8	0.664	0.697	0.618	153	2.59	304	0.203

Flowchart showing the process from Driving Forces to Pressures, State, Impacts, and Responses, leading to Alternatives.

Graph showing a probability distribution $P(a,b)$ with parameters $d(a,b)$ and $d(b,a)$.



GUI components include: Graphics, Sound, Help/Hypertext Management System, Ontology System, Report Management System, Texts, and Graphics.

Screenshots show: Cocoon software interface, a report titled 'Bericht erstellen', and a 'Standardbericht' window.

Community of Practice

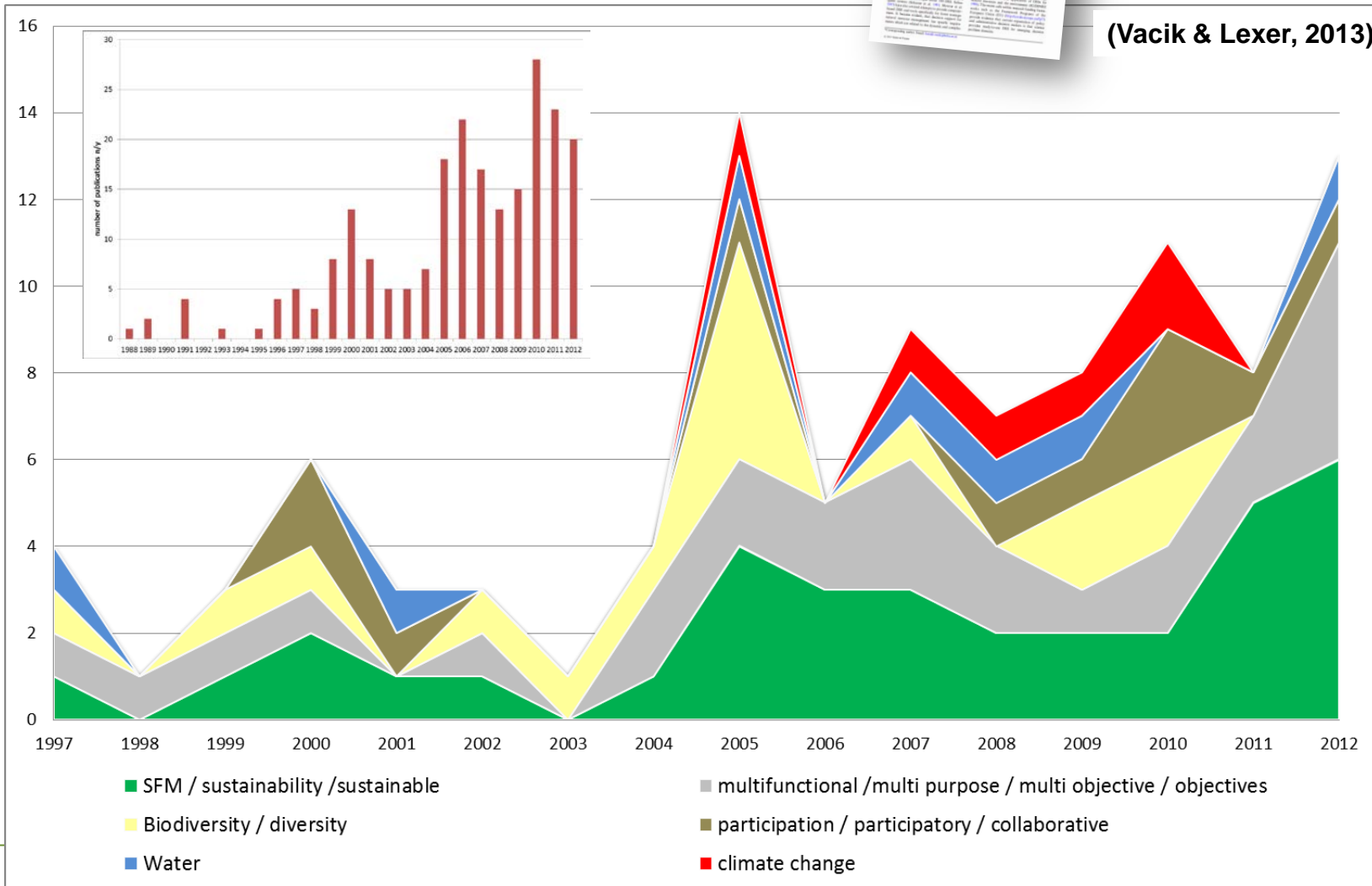
www.ForestDSS.org

- originated from EU funded COST Action FORSYS
- network of more than 120 experts from 26 countries in Africa, America, Asia and Europe
- participants built an online information repository to share information on FMDSS and their application
 - 57 descriptions of software systems
 - 26 country reports
 - 30 case studies and a survey among CoP experts
 - 80 Lessons learned
 - Large number of publications and reports

Problem domains of FMDSS in scientific literature



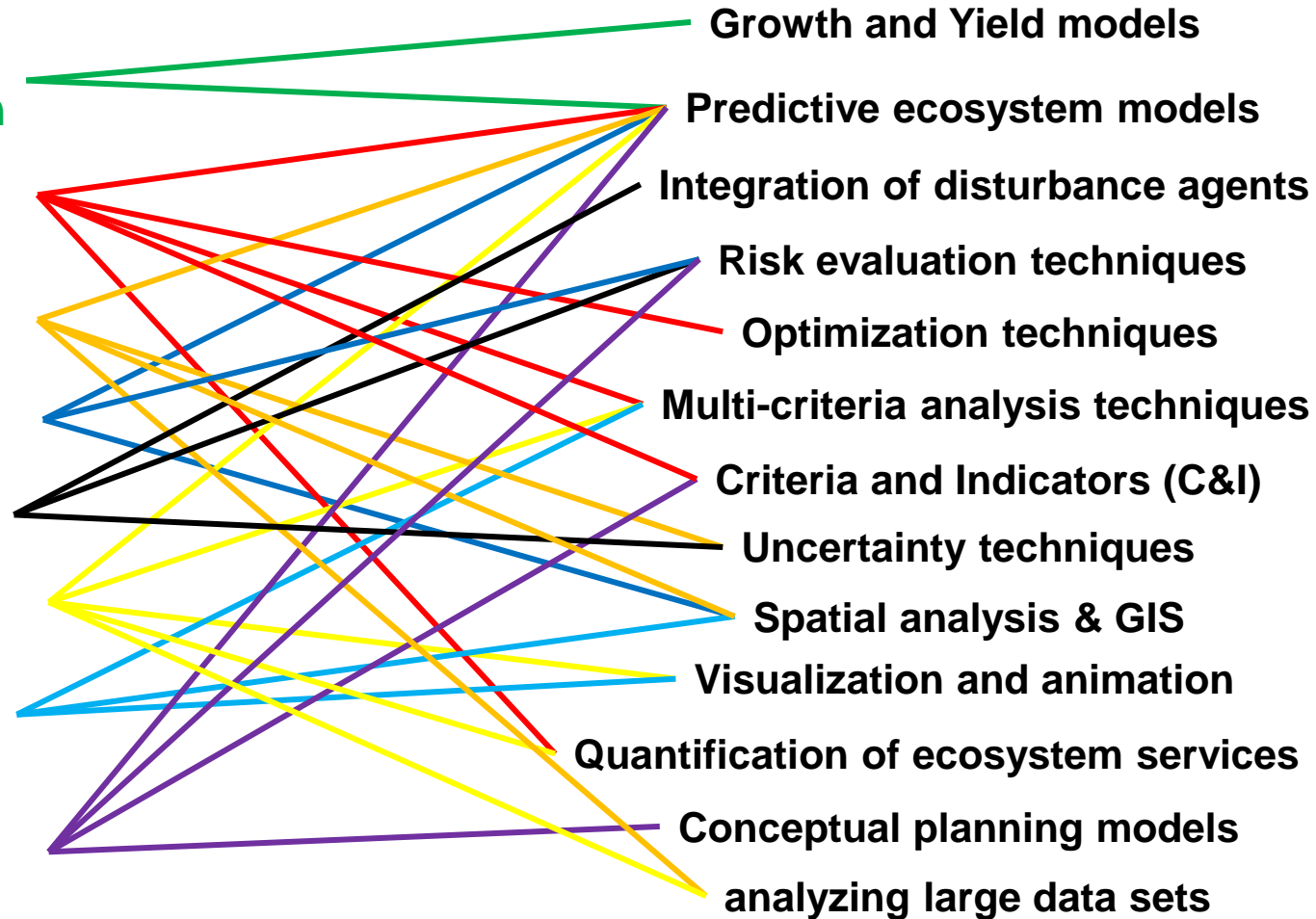
Query: ["decision support systems" OR "DSS" OR "decision support tool" AND "forest management" OR "forest planning"] in title and author-keywords english scientific publications in SCOPUS
 Total number: 223 publications



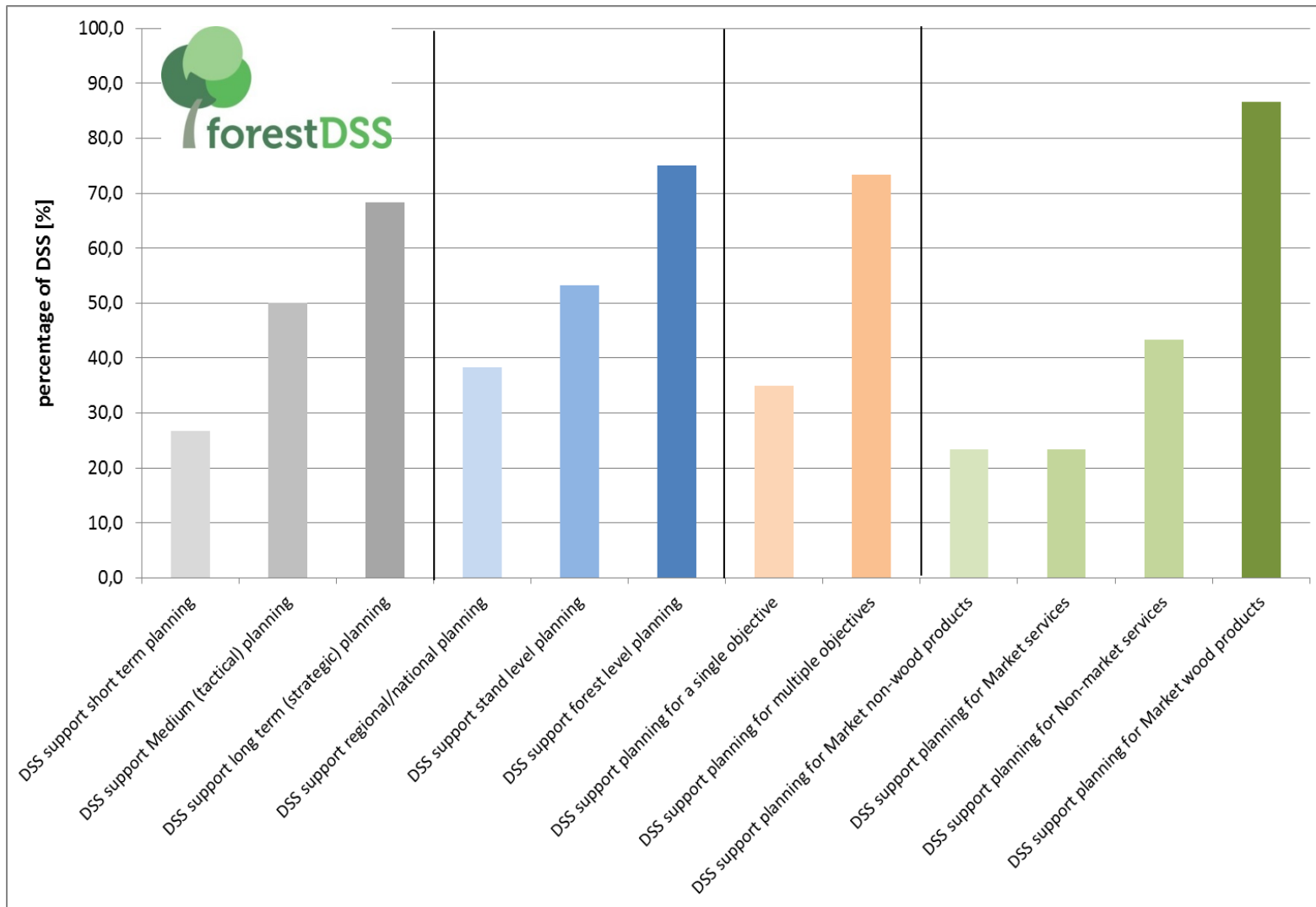
Demands for DSS in Forest management providing ecosystem services under climate change



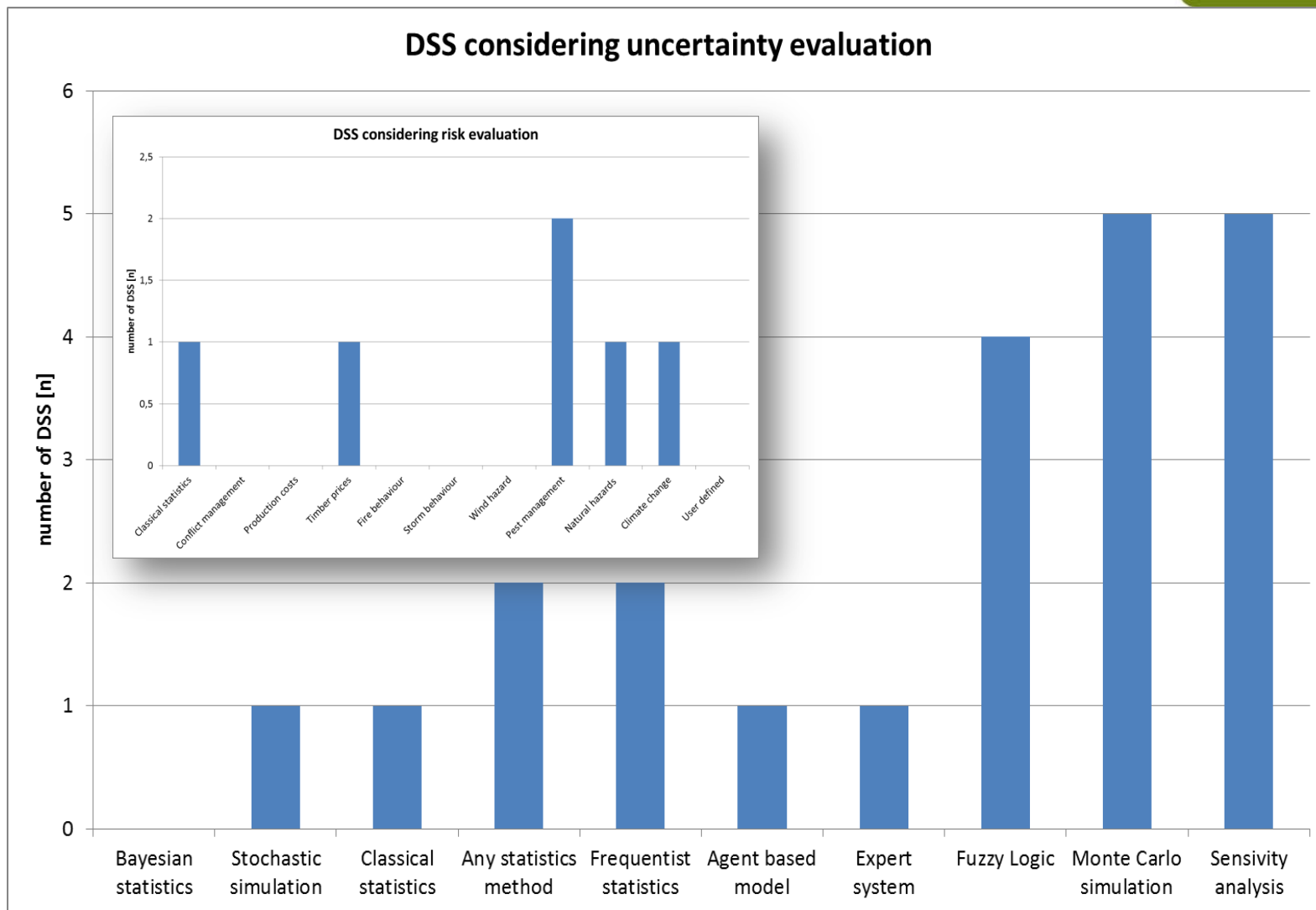
timber production
carbon sequestration
ensuring
multi-functionality
climate change
scenarios
Invasive species
biotic and abiotic
threats
Land use change
importance of
public participation
applying
adaptive management



Categorisation of decision support systems

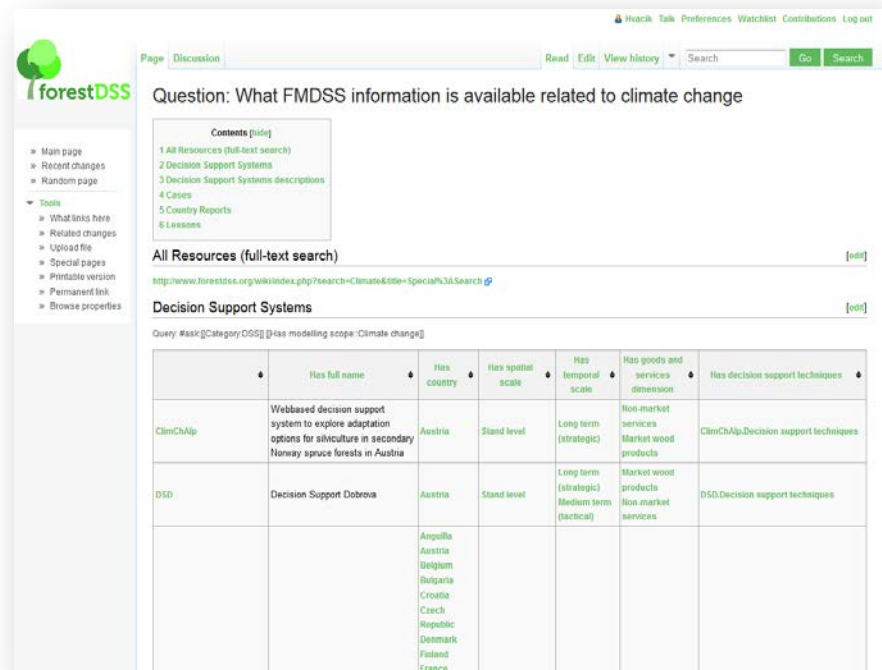


DSS considering risk & uncertainty



Exploring the ForestDSS Resources

- “Climate change” as a keyword in a minority of resources:
 - 7 out of 22 country reports
 - 8 of 57 DSS
 - 5 of 30 case studies
 - 0 of 80 lessons



The screenshot shows the ForestDSS website interface. At the top, there is a navigation bar with links for 'Home', 'Talk', 'Preferences', 'Watchlist', 'Contributions', and 'Log out'. Below this is a search bar with the text 'Question: What FMDSS information is available related to climate change'. The search results are displayed in a table format.

Contents (hide)

- All Resources (full-text search)
- Decision Support Systems
- Decision Support Systems descriptions
- Cases
- Country Reports
- Lessons

All Resources (full-text search) [edit]
<http://www.forestdss.org/wiki/index.php?search=Climate&title=Special%3ASearch>

Decision Support Systems [edit]
 Query: #ask[[Category:DSS]]|Has modelling scope: Climate change]]

	Has full name	Has country	Has spatial scale	Has temporal scale	Has goods and services dimension	Has decision support techniques
ClimChAlp	Webbased decision support system to explore adaptation options for silviculture in secondary Norway spruce forests in Austria	Austria	Stand level	Long term (strategic)	Non-market services Market wood products	ClimChAlp,Decision support techniques
DSD	Decision Support Dobrova	Austria	Stand level	Long term (strategic) Medium term (technical)	Market wood products Non-market services	DSD,Decision support techniques
		Argentina Austria Belgium Bulgaria Canada Czech Republic Denmark Finland France				

Evaluation of selected DSS



DSS acronym	AFM ToolBox	Clim Chalp	DSD	Heureka	SAD fLOR	Sim4 Tree	Gis Came	EFISCEN	EFIMOD	SIM PPLLE	MAPSS	LANDIS	FVS
includes risk evaluation	Index	No	No	No	No	No	No	No	No	No	No	No	No
uncertainty evaluation	Stochastic simulation	Stochastic simulation	Fuzzy Logic	Stochastic simulation	Sensitivity analysis	Stochastic simulation	Sensitivity analysis	Sensitivity analysis	Frequency statistics, Heuristics Monte Carlo simulation	Stochastic simulation	Sensitivity analysis	Stochastic simulation	Partly (multiple runs)
disturbances	Bark beetle, storm	Bark beetle, storm	Snow breakage, pests	Forecasts	climate change impact	climate change impact	climate change impact	climate change impact	climate change impact, natural hazards	Impacts of Insect, diseases, fire	climate change impact	climate change, fire, wind, insects	climate change, fire, insects
carbon sequestration	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Land-use changes	No	No	No	No	No	No	Yes	No	Yes	Yes	Yes	No	No
Invasive species	No	No	No	No	No	No	No	No	No	Yes	No	Yes	No
Shifting vegetation	partly Yes	partly Yes	No	No	No	partly Yes	No	No	partly Yes	Yes	Yes	Yes	Yes
Includes MCA techniques	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	No	No	No	No
Temporal scale	Long term	Long term	Long and short term	Long term Medium term	Long term	Long term Medium term	Long term	Long term Medium term	Long term Medium term	Long term Medium term	Long term	Short Medium Long	Medium Long
Spatial scale	Stand and Forest level	Stand level	Stand level	Regional level	Stand Forest national	Stand Forest national	Regional/n ational level	Regional/n ational level	Stand and Forest level	Regional/n ational level	Regional/n ational level	Forest Regional/n ational	Stand and Forest level
Objectives dimension	Multiple	Multiple	Multiple	Multiple	Multiple	Multiple	Multiple	Single /Multiple	Multiple	Multiple	single	Multiple	Multiple
Ecosystem services	Market wood products, Non-market services	Market wood products, Non-market services	Market wood products, Non-market services	Market wood products, Non-market services	Market non-wood products, Market wood products	Market wood products,	Market wood and non-wood products, Market and non-market	Market wood products, Non-market services	Market wood products, Non-market services	Market wood products, Non-market services	Non-market services	Market wood products, Non-market services	Market wood products, Non-market services



An European example the AFM Toolbox

A web-based tool box approach to support adaptive forest
management <http://www.afm-toolbox.net>

The ToolBox approach



Web-based
low-barrier access



different types
of knowledge
information, examples, FAQs



collection of
different tools
vulnerability assessment, MIP
optimization, niche models, ...



targets different users
useful knowledge for managers (DIY)
and analysts (consultants)



home

getting started

adaptive forest management

tools

FAQ

examples

make your own

WELCOME TO THE ADAPTIVE FOREST MANAGEMENT TOOL BOX!

To assist in forest management under climate change this site provides background information, approaches and principles to adaptive management, interactive tools to support planning, examples across Europe and FAQs.

Learn more about the Adaptive Forest Management Approach!

TOOLS

CLIMATE CHANGE

ADAPTIVE FOREST MANGEMENT

search



This project is supported by the European Commission under the Environment (including climate change) Theme of the 7th Framework Programme for Research and Technological Development





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You are here: HOME > Adaptive Forest Management Cycle

THE ADAPTIVE FOREST MANAGEMENT CYCLE

Adaptive management is a structured, iterative management process to cope with uncertainty. The idea is that management actions are taken in a way (PLAN, ACT) that an eventual failure to meet the objectives is not irreversible, that the reasons of failure can be detected in periodic evaluations (MONITOR, EVALUATE) through monitoring of the managed system and that corrective measures can then be set accordingly. To learn more choose a adaptive forest management step below.

[Learn more!](#)

Manager View

Analyst View



[Learn more about the AFM Step "MONITOR" here](#)

- [+ CONCEPTS - MONITOR](#)
- [+ TOOLS - MONITOR](#)
- [+ FAQ - MONITOR](#)

search



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You are here: HOME > regional examples > Montafon (Austria)

MONTAFON (AUSTRIA)

- FORESTS

More than two thirds of the valley is forested. The case study focuses on the forests of the Stand Montafon, a forest management unit with 6470 ha of forest. The forests are dominated by Norway spruce (96% of growing stock) and European silver fir (3%) with some admixed European beech, Scots pine and European larch (see the major forest types in Figure 1). The largest part of the forest is located above 1200 m.a.s.l. on steep slopes which makes management difficult and requires skyline based logging techniques. Timber production is a relevant business supporting regional sawmills with rawmaterial and local residents regarding to historic timber rights. Most of the forests serve also protective functions against gravitational natural hazards, like snow avalanche, rock fall, landslide, debris flows, erosion, and flooding.



Figure 1

- + FORESTS IN THE MONTAFON
- + CURRENT CLIMATE AND CLIMATE CHANGE SCENARIOS
- + WILL THE RISK PROFILE OF TREE SPECIES CHANGE UNDER CLIMATE CHANGE?
- + ARE TREE SPECIES IN THE FOREST SENSITIVE TO CLIMATE CHANGE?

search



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HOME

Dashboard

SELECT CASES

18 cases selected!

DEFINE PREFERENCES

Preference "timber oriented" selected!

ANALYZE RESULTS

Do some Multi- and Single Case Analysis!

ANALYSIS HOME

SHOW CASES

IMPACT ANALYSIS

Getting started with the analysis - Chose your main question below!



What is the predicted impact of climate change under current management (BAU - business as usual)?

START ANALYSIS



HOME

Dashboard

SELECT CASES

53 cases selected!

DEFINE PREFERENCES

Preference "all equal" selected!

ANALYZE RESULTS

Do some Multi- and Single Case Analysis!

ANALYSIS HOME

SHOW CASES

IMPACT ANALYSIS

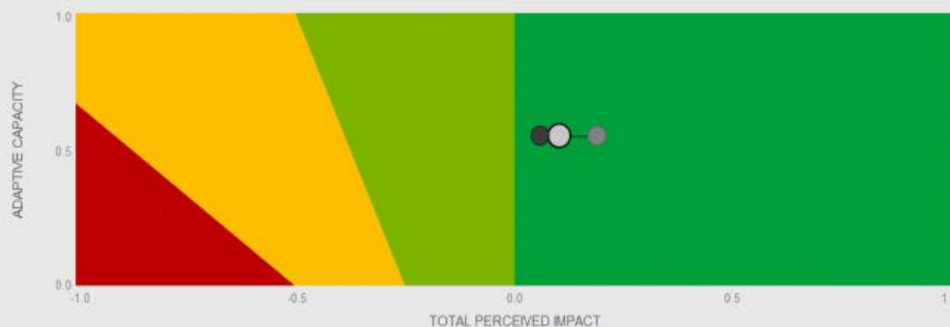
MULTI-CASE IMPACT ANALYSIS

DETAILVIEW: VULNERABILITY ASSESSMENT FOR A SELECTED CASE

Q1: Please judge the level of institutional support: low moderate high Importance: 45.24%

Q2: Please rate the required financial investment for adaptive measures: low moderate high Importance: 14.29%

Q3: Please rate the availability of skilled work force: low moderate high Importance: 40.48%



DETAILVIEW: DISAGGREGATED IMPACTS FOR A SELECTED CASE

EXPORT CURRENT IMPACT DATA

For further analysis (and for documentation purposes), the results of the current analysis can be exported. The level of detail can be selected using the checkboxes: Clicking on "Export Data Now" generates a HTML report in a new browser window. The data export page contains some meta data like date and used data source, a detailed list of the selected cases, the used preference pattern, and the desired impact values that are also used for the visualizations throughout the tool GUI.

Close Help Panel

Choose export-options and click on the button to open a new tab/window with a plain-html datapage of your current analysis!

Include indicator-level impacts Include ecosystemservice-level impacts **Export Data Now!**

DETAILVIEW: VULNERABILITY ASSESSMENT FOR A SELECTED CASE



ANALYZE RESULTS

Do some Multi- and Single Case Analysis!

Indicators control panel with four rows of sliders and indicator icons.





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Sciences

Conclusions



Critical evaluation of DSS providing ecosystem services under climate change

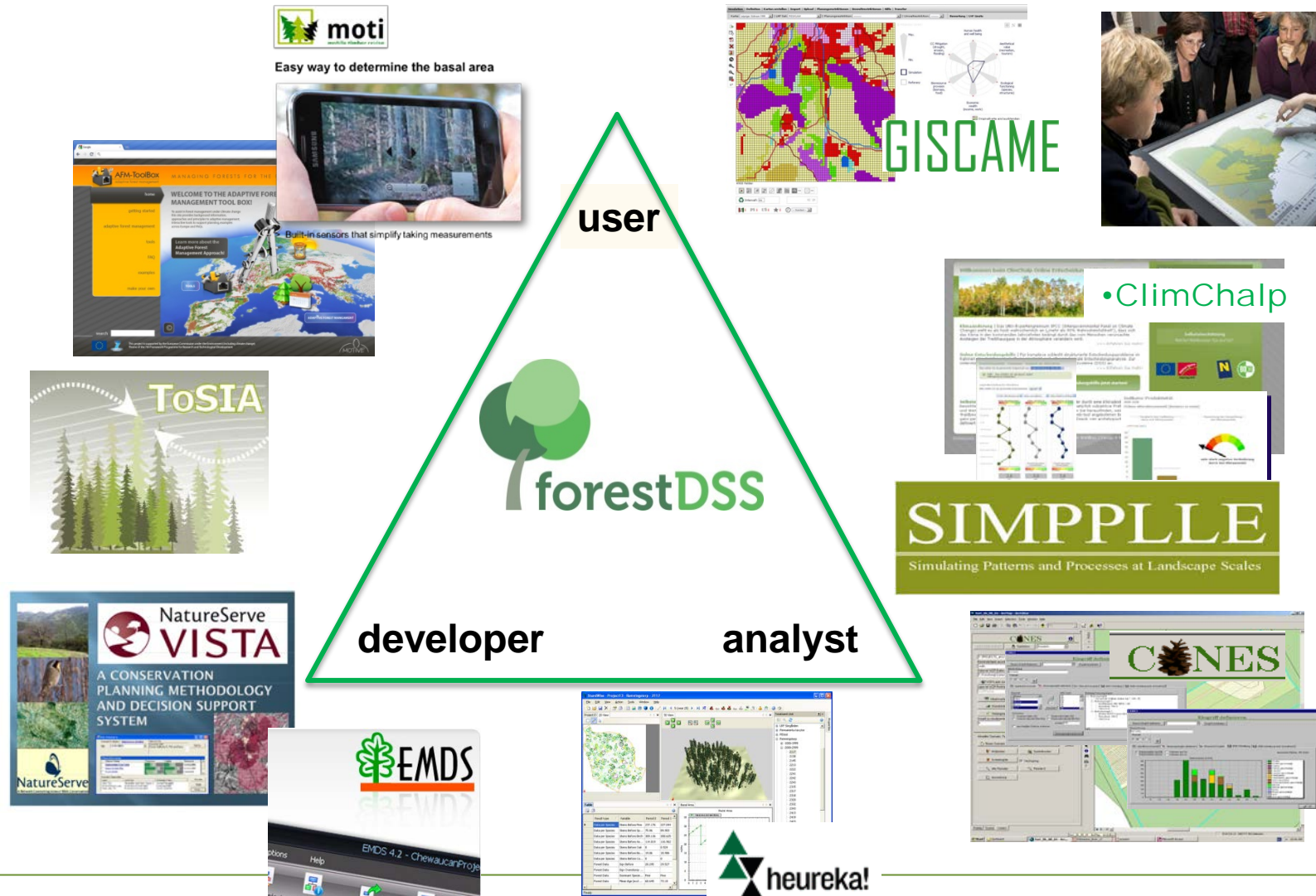
- Ecosystem models should consider
 - carbon sequestration (often relatively simple equations for above and below ground biomass; bigger challenge likely to be forest soils)
 - land-use changes (market prices that influence land tenure)
 - shifts in vegetation patterns (migration of species, invasive species)
 - Interaction with biotic (pest, diseases) and abiotic (fire, storm) agents sensitive to changing weather conditions
- higher number of ecosystem services and objectives are to be evaluated (e.g. gaps in NWFP's, social and amenity services)

Critical evaluation of DSS providing ecosystem services under climate change

- Improved vulnerability assessment: DSS should include a risk evaluation framework: $\text{exposure} \times \text{sensitivity} = \text{risk}$
 - Exposures (disturbances: fire, storm, bark beetles, drought; Land-use changes; Shift of vegetation patterns)
 - Sensitivity: growth, propagation, shifts in vegetation patterns
- considering uncertainty with regard to social, ecological and economic processes and exposure levels
- Include multiple evaluation techniques (MCA, optimizing techniques and heuristics for multiple resources considering trade-offs)

Complex demands in DSS development

ask for interaction between developers, users and analysts





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Thanks for your attention!

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