

# Publizierbarer Endbericht

Gilt für Studien aus der Programmlinie Forschung

## A) Projektdaten

Allgemeines zum Projekt	
<b>Kurztitel:</b>	RAPs.AT
<b>Langtitel:</b>	Participatory Development of Representative Agricultural Pathways for Austria
<b>Zitervorschlag:</b>	RAPs.AT
<b>Programm inkl. Jahr:</b>	ACRP 8th Call for Proposals 2015
<b>Dauer:</b>	01.07.2019 bis 31.07.2019
<b>KoordinatorIn/ ProjekteinreicherIn:</b>	University of Natural Resources and Life Sciences (BOKU)
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<b>Schlagwörter:</b>	Climate change, storylines, agriculture, Europe
<b>Projektgesamtkosten:</b>	134.902 €
<b>Fördersumme:</b>	132.028 €
<b>Klimafonds-Nr:</b>	KR15AC8K12675
<b>Erstellt am:</b>	07.11.2019

## B) Project Overview

### 1 Kurzfassung

Im Zuge des 5. Assessment Reports der IPCC wurde ein neues Prozedere der parallelen Szenarientwicklung eingeführt. Die internationale Klimaforschungsgemeinschaft entwickelte sozio-ökonomische Szenarien (Shared Socioeconomic Pathways; SSPs), die den Repräsentativen Konzentrationspfaden (RCPs) zugewiesen werden können. Die unmittelbare Verwendbarkeit dieser SSPs für regionale und sektorale Analysen ist aber aufgrund der niedrigen Auflösung der SSPs nur eingeschränkt möglich. Es bräuchte daher sektorale und/oder regionale Storylines (Narrative), die auf den SSPs aufbauen. RAPs.AT schließt diese Lücke. Im Zuge des Projekts wurden fünf qualitative Storylines für den Europäischen Agrarsektor entwickelt, die „Shared Socio-Economic Pathways for European Agriculture“ (Eur-Agri-SSPs). Die Eur-Agri-SSPs decken ein breites Feld an möglichen Zukünften des Agrarsektors bis 2050 ab und garantieren u.a. Konsistenz in der Klimawandelforschung. Detaillierte Projektziele inkludierten:

- Erstellung eines Protokolls zur systematischen Erarbeitung der Eur-Agri-SSPs.
- Angleichung des Prozesses zur Erstellung der Eur-Agri-SSPs an ähnliche internationale Aktivitäten (e.g. AgMIP, MACSUR).
- Entwicklung der Eur-Agri-SSPs auf Grundlage des Protokolls und unter Einbindung von Stakeholdern

Ein erster Schritt in RAPs.AT war die Entwicklung einer Methode (i.e. Protokoll) zur Erstellung der Eur-Agri-SSPs. Das durch RAPs.AT verfügbare Protokoll geht aber über diesen Anwendungsbereich hinaus und kann für die Entwicklung von Storylines auf anderen räumlichen Ebenen und für andere Sektoren verwendet werden. Um die Eur-Agri-SSPs zu entwickeln, wurde ein europäischer Stakeholderprozess ins Leben gerufen. Rund 50 gezielt ausgewählte Stakeholder trugen mit Interviews zur Gestaltung bei, andere übernahmen methodische und inhaltliche Gutachtertätigkeiten zu unterschiedlichen Projektschritten.

Die Eur-Agri-SSPs sind ähnlich strukturiert wie die SSPs. Sie beinhalten die fünf Hauptkategorien Bevölkerung und Urbanisierung, Wirtschaft, Politik und Institutionen, Technologie, sowie Umwelt und Ressourcenschutz. Jede der fünf Storylines besteht aus einer Zusammenfassung, einem Haupttext, einer Einschätzung der Potenziale für Klimawandelmitigation und – anpassung sowie eine Tabelle, die die Richtungsänderungen der Elemente beschreibt. Eine wichtige Innovation der Eur-Agri-SSPs ist deren partizipative protokoll-basierte Entwicklung in einer Forschungsallianz, d.h. einem internationalen und interdisziplinären Team mit Wissenschaftlerinnen und Wissenschaftlern aus 15 Organisationen und 9 Ländern zugänglich der EU.

Die Verbreitungsaktivitäten der Methode sowie der Eur-Agri-SSPs erfolgten vorwiegend über wissenschaftliche Konferenzen. Ein Hauptweg der Verbreitung ist die Projekthomepage [eur-agri-ssps.boku.ac.at](http://eur-agri-ssps.boku.ac.at), die einen niederschweligen Einstieg in die Thematik und – nach vollständiger wissenschaftlicher Publikation – auch alle Eur-Agri-SSPs enthalten wird. Die Storylines stehen WissenschaftlerInnen, MitarbeiterInnen europäischer und nationaler Verwaltungen sowie privaten Firmen im Agrarsektor zur Verfügung und sollen ein qualifiziertes Planen ermöglichen. Eine lohnenswerte Anwendung wären etwa Modellvergleichsstudien zur Verbesserung der Methoden in der Klimaforschung (z.B. [www.macsur.eu](http://www.macsur.eu) und [www.agmip.org](http://www.agmip.org)).

## 2 Executive Summary

In the 5<sup>th</sup> IPCC Assessment Report period a new procedure of parallel scenario definition has been introduced. Modelling communities developed Shared Socio-economic Pathways (SSPs), which can be attributed to particular Representative Concentration Pathways (RCPs). But there are limits to this approach in terms of spatial resolution and scope. In particular, aspects for global to local mitigation, adaptation, and impact studies of climate change in economic sectors such as agriculture are not well integrated in this framework. By defining sectoral storylines, gaps in scenario parameters can be overcome. RAPS.AT closed this gap. It developed five qualitative storylines for Europe, the Shared Socio-Economic Pathways for European Agriculture (Eur-Agri-SSPs). They are available for the European research community and the wider public. The Eur-Agri-SSPs cover a broad range of plausible futures in the agricultural sector until 2050 and guarantee a consistent representation and translation of GHG emissions to socio-economic outcomes via climate change scenarios. Detailed project aims include:

- creating a protocol for the systematic development of Eur-Agri-SSPs,
- aligning Eur-Agri-SSPs with international activities (e.g. AgMIP, MACSUR),
- defining Eur-Agri-SSPs based on the protocol and a consultation of major international research groups and stakeholders

Hence, a methodology (i.e. protocol) to define Eur-Agri-SSPs was developed. It is readily available to storyline processes in other sectors than agriculture and for other spatial scales (e.g. Austria) than the European level. To develop the Eur-Agri-SSPs based on this protocol, a collection and mapping exercise of relevant research organisations and stakeholders in Europe has been achieved. Selected stakeholders were interviewed and invited to comment on crucial project steps towards the Eur-Agri-SSPs, which finally resulted in storylines consistent with the five SSPs.

The Eur-Agri-SSPs are structured similarly to the SSPs and cover the major topics Population and urbanization; Economy; Policies and institutions; Technology; Environment and natural resources. Each storyline consists of a summary, storyline main text, an evaluation of mitigation and adaptation potentials, and a table

indicating the directions of change of each storyline element. The major innovation of the Eur-Agri-SSPs is their protocol-based development in an international and interdisciplinary team of scientists, i.e. a research alliance of 15 European research organizations from 9 countries and the EU, and with a large stakeholder engagement process.

Dissemination activities focused on the distribution of the Eur-Agri-SSPs via scientific conferences. A main distribution channel is the homepage [eur-agri-ssps.boku.ac.at](http://eur-agri-ssps.boku.ac.at), which provides easily accessible information and comment functions. It shall be a mean to support the application of Eur-Agri-SSPs in research, policy making, or private investment planning. Next steps should include the downscaling of Eur-Agri-SSPs to the national level and the quantification of parameters. A likely fruitful application would be ensemble runs and model inter-comparisons to improve methods of climate change research (see e.g. [www.macsur.eu](http://www.macsur.eu) and [www.agmip.org](http://www.agmip.org)).

### 3 Background information and objectives

Climate change research heavily depends on scenarios. A typical assessment chain spans from green-house-gas (GHG) emissions to socio-economic impact, adaptation, and mitigation studies. Projections of GHG emissions and assumptions on land use change are used as the key drivers in General Circulation Models (GCM). The resulting climate change scenarios are used by bio-physical impact models taking into account scenarios about CO<sub>2</sub>-concentrations and technological progress, among them new breeds and improved technologies. The scenario outputs of such models, e.g. crop yields under climate change, are often linked with scenarios on socio-economic developments and policies as inputs to integrated assessment models. A typical research process includes scenarios to transfer information among research areas, to explore multiple futures for robust decision making, and to handle uncertainties.

With the 5<sup>th</sup> IPCC Assessment Report period a new procedure of parallel scenario definition and thereby a new set of scenarios has been introduced. It aims at better addressing the needs of the research community by shorten the definition process, by satisfying the increasing data demand, and by providing more flexibility and better integration of the results from different research communities. At the starting point there are no longer socio-economic scenarios but scenarios on alternative GHG concentrations, i.e. Representative Concentration Pathways (RCPs). RCPs are input to GCMs while socio-economic scenarios have to be defined in parallel (Moss et al., 2010. *Nature* 463, 747–756). Each RCP can result from multiple future combinations of economic, technological, demographic, policy and institutional settings, which can be defined by integrated assessment modelling. Kriegler et al. (2012. *Global Environmental Change* 22, 807–822) raised several arguments in favour of a concerted action towards the definition and application of such socio-economic scenarios. An aligned development of the

climate change research communities, utilizing synergies among research projects, the coverage of the whole solution space, and a better and more consistent integration of mitigation, adaptation, and impact study results require minimum levels of harmonization.

As a response, modelling communities developed so-called Shared Socioeconomic Pathways (SSPs), which can be attributed to particular RCPs. SSPs consist of “a parsimonious narrative capturing the key dimensions of the underlying global scale socio-economic development and a collection of quantitative projections for global socio-economic boundary conditions.” (Kriegler et al., 2012 p. 808). They are alternative pathways in the development of the society and natural systems in the 21<sup>st</sup> century (O’Neill et al., 2013. *Climatic Change* 122, 387–400) and describe a world without future climate policy – the latter to be eventually subject to shared climate policy assumptions (SPAs) (Kriegler et al., 2012). SSPs may capture indicators on demographic and economic development, on welfare, the environment, resource availability and use, institutions and governance, technological development, social development, and policies and may be available as basic and extended indicator set (O’Neill et al., 2013). Five domains of SSPs have been defined along two gradients of socio-economic challenges to adaptation and mitigation, but the number of SSPs is subject to scientific debate (O’Neill et al., 2013). Quantified SSP parameters have been made available in the SSP Database by a shared effort of global modelling groups. It captures a range of indicators including demographic and economic development, energy supply and demand, land use and GHG emissions. SSPs currently include their narratives along the five domains (O’Neill et al., 2017. *Global Environmental Change* 42, 169–180), i.e. fossil-fuelled development, regional rivalry, middle of the road, sustainability, inequality. Following this route, researchers have started to develop quantitative assessments at global scales.

SSPs are available at global to continental scales and describe major socio-economic situations. Such spatial and thematic resolution may be sufficient for global to regional impact assessments of the whole economy and for a consistent derivation of RCPs, but they likely are too coarse for global to local mitigation, adaptation and impact studies of climate change in a particular sector such as agriculture. Consequently, high spatial resolution and a more detailed description of framework conditions for each SSP is required (see for example Wiebe et al., 2015. *Environ. Res. Lett.* 10, 085010). This gap can be overcome by defining alternative storylines, e.g. Representative Agricultural Pathways (RAPs) (Valdivia et al., 2014. In: Rosenzweig, C., Hillel, D. (Eds.), *Handbook of Climate Change and Agroecosystems*, Imperial College Press, London, pp. 101–145.). They shall follow the logic of the parallel scenario definition process and shall be derived from and assigned to particular SSPs. They shall cover the range of plausible futures in the agricultural sector, shall be contrasting among each other but consistent to SSPs and RCPs. A major argument is expressed by Rosenzweig et al. (2013. *Agricultural and Forest Meteorology* 170, p. 175): “RAPs will also contribute to standardizing agricultural model simulations of future conditions, allowing

independent researchers to directly compare their results.”. Such comparison efforts are mirrored by the initiatives such as the Regional Model Inter-comparison Project (ReMIP) within AgMIP. Furthermore, the European Knowledge Hub FACCE MACSUR (Modelling European Agriculture with Climate Change for Food Security, [www.macsur.eu](http://www.macsur.eu)) covered the definition of regional storylines in its second project phase to improve the comparability among its regional case studies on climate change adaptation.

This discussion revealed the pressing need for the definition of storylines related to the SSPs at multiple spatial scales, i.e. from the global to the local level, to support agricultural mitigation, adaptation and impact studies applying quantitative models as well as qualitative studies and stakeholder discourses on climate change. Storylines would facilitate a consistent representation and translation of GHG emissions to socio-economic outcomes via climate change scenarios.

Besides methodological objectives, our experiences with stakeholders – from farmers to public administration – reveal a demand for comparability among research results as stakeholders are puzzled by sometimes contradictory results from alternative climate and socio-economic assumptions. A collaborative effort to define storylines also saves resources by sharing knowledge among research groups.

## 4 Project content and results

### Project objectives

The primary objective of this research project was to develop a coherent set of scenarios that can be used by researchers of various disciplines, stakeholders from different sectors and the civil society to:

- check whether their beliefs about future developments are consistent with up to date projections in the scientific literature and the views of businesses with plans over long time scales,
- develop adaptation strategies that address future challenges and opportunities reflecting strength and weaknesses of resource endowments,
- contribute to the efforts of research teams all over the world on formulating region specific storylines by developing storylines for Europe.

The research was conducted in close co-operation with international partners being involved in equivalent parallel efforts and by using novel ways of stakeholder interaction. Previous work on analysing consequences of climate change with elaborated modelling approaches and other means showed that the traditional ways of knowledge transfer are insufficient to meet the challenges lying ahead of society. What is needed are new ways of knowledge exchange that tap on the views, beliefs and information of all those affected by a changing climate and societal developments. In more detail, the project RAPs.AT aimed on contributing to the revealed gap in the European climate change research community by:

- developing European storylines for the five major SSPs until 2050,
- aligning the process with AgMIP and MACSUR procedures to guarantee consistency to global SSPs and European to global RAPs or similar storyline portfolios,
- defining storylines based on a consultation of major European research groups in climate change and land use science as well as all relevant stakeholders of the agricultural sector.

### **Important working steps and activities**

#### *Evaluation of research and stakeholder needs in terms of storylines for the agricultural sector (WP1)*

In an early project phase, we evaluated the needs of the scientific and public policy sector concerning storylines for the agricultural sector. This happened at the national level as part of scientific conferences (e.g. annual conference of the Austrian Society of Agricultural Economics) and informal talks (e.g. meeting of land use scientists) and at international level in scientific conferences and activities as part of the MACSUR network (e.g. RAPs.AT session at the FACCE MACSUR workshop for policymakers 2017, 11 May 2017, Brussels).

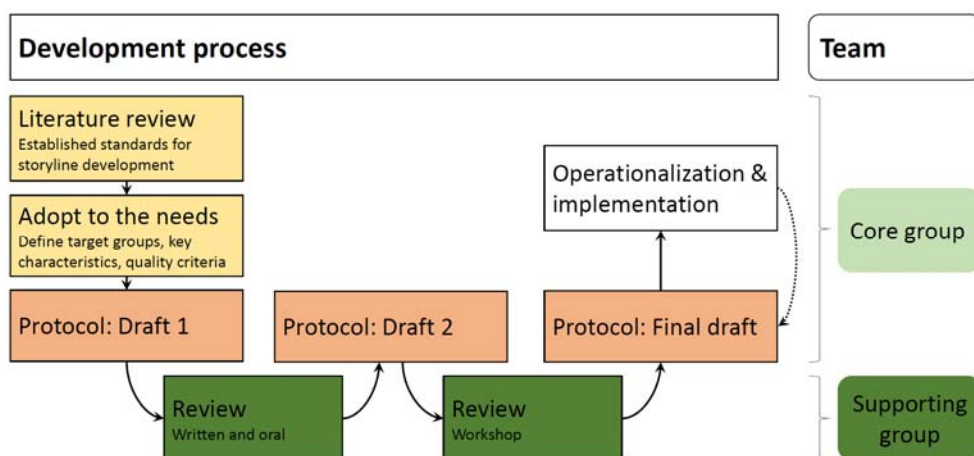
These activities revealed two facts with strong impacts on the remaining project: i) the Austrian agricultural sector is strongly dependent on international developments particularly within Europe, and ii) several European research groups had been working in parallel on storylines related to the SSPs. We concluded that it would be wise to shift the focus from the Austrian to the European scale and to utilize available research capacities in a joint effort.

#### *The establishment and lead of a European research alliance to develop Shared Socio-economic Pathways for European Agriculture (WP1)*

Hence, we shifted the project focus from the national to the European level and organized a voluntary research alliance to share resources and expertise. Its initialization benefited from the well-established MACSUR network of climate change researchers and modelers. First contacts and a snowball sampling among colleagues resulted in a list of potentially interested colleagues. We invited them to a workshop as side event to the Landscape 2018 conference in Berlin in March 2018. Since then, we have been leading this alliance as part of our activities in RAPs.AT. To benefit from activities in the AgMIP consortium, an international community dedicated to climate change research in agriculture, Roberto Valdivia became project advisor.

*The design of a protocol to develop storylines based on up-to-date research standards and consistent with the SSPs (WP1)*

The protocol shall guarantee a transparent and reproducible design of storylines based on today's standards of futures studies. Furthermore, it shall be readily applicable to a smaller scale scenario development at national, regional, or local level. Figure 1 shows the methodology towards the protocol design.



**Figure 1: Methodology towards the protocol**

*The maintenance of an extensive stakeholder process (WP2)*

Stakeholder activities in RAPs.AT have been undertaken prior to the formal storyline development process to prove the concept. As part of the formal storyline development process, a stakeholder group of European agricultural experts has been involved in several phases.

*The development of participatory Shared Socio-economic Pathways for European Agriculture based on the protocol (WP3)*

The major project step in RAPs.AT has been the design of Shared Socio-economic Pathways for European Agriculture (Eur-Agri-SSPs). It strictly followed the protocol with multiple feedback loops and resulted in five storylines including supplementary material. We led this process as part of our RAPs.AT activities and formed the core group together with RAPs.AT partners from ZALF (see Mitter et al., 2019). Most partners in the research alliance participated as supporting group members, among others financed by different research projects.

*Dissemination of research results (WP4)*

Dissemination of results shall reach all groups of potential addressees, which are the scientific community mainly involved modelling agricultural systems and non-academic stakeholders involved in agricultural sector businesses, extension, policy planning and implementation. Hence, dissemination activities included the



participation at scientific conferences, the publication of scientific and non-scientific articles (e.g. in newspapers) and the release of the eur-agri-ssps.boku.ac.at homepage.

### Major project outputs

RAPs.AT's major outputs are threefold. The establishment of a research alliance to develop Eur-Agri-SSPs is somewhat unique, since it is an informal network without any dedicated funding. We have been able to lead this initiative as part of RAPs.AT.

The second highlight is the protocol. Its main purpose has been to guide the Eur-Agri-SSP development. However, the protocol likely fits to scales below the European level and may be applied to storyline designs of sectors other than agriculture.

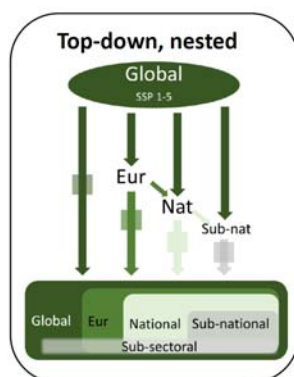
The third highlight are the storylines. Their origin from international cooperation leads to a quality that can hardly be achieved by single projects. Their spatial coverage opens dissemination channels and potential use all over Europe.

#### *Eur-Agri-SSP research alliance*

RAPs.AT maintained and opened the MACSUR network ([www.macsur.eu](http://www.macsur.eu)) via the established research alliance on Eur-Agri-SSPs. It comprised researchers from 15 organizations in 9 countries as well as the EU (JRC). The alliance activities included collaboration on the protocol and the storylines. Two dedicated workshops (Berlin 2018; Brussels 2019) took place. Bilateral meetings took place occasionally.

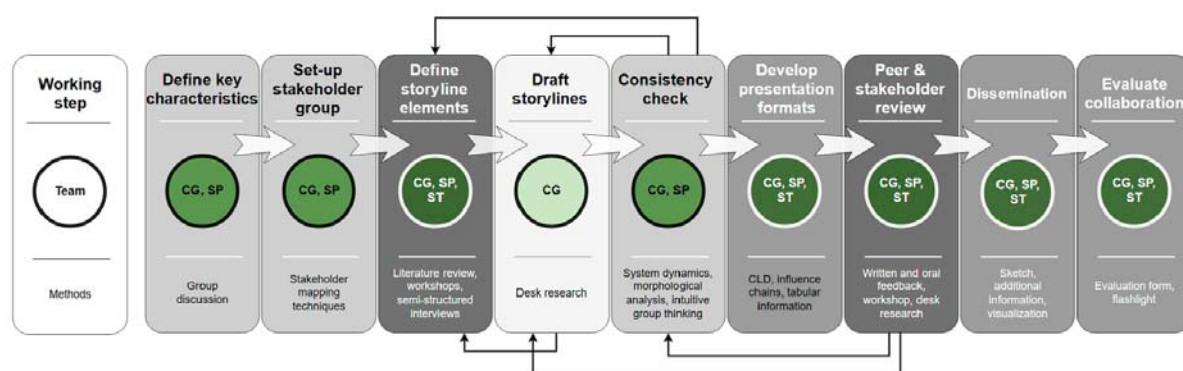
#### *Eur-Agri-SSP protocol*

Figure 2 presents the scales and interlinkages of the different storylines, which guided the design of the protocol to develop the Eur-Agri-SSPs.



**Figure 2: Scales of storylines from global to regional level**

The protocol covers nine partly consecutive and partly repeating working steps (Figure 3). It differentiates three groups of collaborators, i.e. a core group that defines major inputs, a supporting group that is strongly involved mainly to review content and finally a stakeholder group that shall provide practical knowledge on expressions of storyline elements, shall raise demand for dissemination products, and validate the storylines. For any methodological details, we refer to the open access publication of the protocol: Mitter et al. 2019. A protocol to develop Shared Socio-economic Pathways for European agriculture. *Journal of Environmental Management* 252, 109701. <https://doi.org/10.1016/j.jenvman.2019.109701>.



**Figure 3: Protocol working steps (Mitter et al., 2019)**

### *Eur-Agri-SSPs*

We developed the Eur-Agri-SSPs following the protocol. The process resulted in five storylines, summary tables, and an evaluation of mitigation and adaptation potentials. At the time of reporting, the manuscript on this process and the final outcome has been under review. All results will be published open access and will be available at the RAPs.AT homepage: <https://eur-agri-ssps.boku.ac.at>.

## 5 Conclusions and outlook

Assessments of the scientific literature and stakeholder interactions, which includes scientific stakeholders and stakeholders outside academia, confirmed the need for storylines of the agricultural sector that are linked to the well accepted SSP concept. A proof of this public interest is the publication by the European Environmental Agency, which mentioned the Eur-Agri-SSPs in its recent report 04/2019 on “Climate change adaptation in the agriculture sector in Europe” (see Annex).

Several research groups in Europe had been working or planned to work on such storylines. This created momentum for a research alliance that could build on the former MACSUR network. We took the opportunity to co-found and lead this alliance towards Eur-Agri-SSPs.

A first step was the design of a protocol to guarantee a reproducible and transparent research process that is based on the most recent methodological achievements and standards of futures studies. The work on the protocol structured discussions about the storyline design, potential applications, necessary working steps to create credibility and trust, stakeholder groups to be involved, evaluation criteria, and dissemination channels. Thereby, plausibility and consistency, richness and creativity, and salience turned out to be crucial quality and evaluation criteria. We published the final protocol in the high ranked Journal of Environmental Management. The protocol did not only guide the Eur-Agri-SSPs development. It is a methodology applicable to storyline design at lower scales such as the national level, where the nested procedure would have to include one further scale, i.e. the European. Furthermore, the protocol may be transferred to other sectors as well.

The protocol led to the design of Eur-Agri-SSPs. Despite this detailed guide towards storylines, the design of the Eur-Agri-SSPs was far from straightforward. The complexity of the agricultural sector with numerous linkages to other sectors, the strong dependency on private demand and policy frameworks – despite impacts from climate change, which had not been of concern in RAPs.AT – as well as interests from different societal groups required multiple evaluations and revisions. To frame the diversity and expression of storyline elements, an extensive stakeholder survey via qualitative interviews of about 50 European stakeholders created the knowledge base for a reasonable choice of future developments. Cross-checks with stakeholders prevented blind spots and unintended biases of researchers. Given the complexity of the process and its potentially high costs, the Eur-Agri-SSPs provoked interest from researchers of various disciplines at scientific conferences so far.

The Eur-Agri-SSPs are a result on its own. However, the storylines need contextualization and downscaling to nation states or regions for certain applications. Furthermore, quantification of major parameters beyond those provided by the SSP community can be necessary. The RAPs.AT team as well as researchers from the alliance thrive for applications of the Eur-Agri-SSPs. Examples for ongoing projects that will utilize the storylines are Surefarm (H2020), BonaRes (Germany), SALBES (Era-Net BiodivERSA), and a foresight study on pesticide use in Europe. All partners are keen to maintain the alliance and there are potential synergies that justify such continuation, such as plans to downscale the Eur-Agri-SSPs to national scales in several European countries.

The RAPs.AT team will maintain the homepage beyond the RAPs.AT project. It has been designed as forum to discuss the usability, potential applications and extensions, as well as potential caveats of the Eur-Agri-SSPs. The collection of applications shall serve the research community as toolbox for storyline design and use in agriculture.

The intensive and broad stakeholder process created material for another publication on perspectives towards European agriculture in the 21st century. The

RAPs.AT team plans another joint publication to make use of this rich data set, which shaped the Eur-Agri-SSPs but could not be used in detail when designing the storylines.

While dissemination activities did mainly cover the scientific community via several scientific conferences so far, the stakeholders involved in the process will also be informed about the final publication of the Eur-Agri-SSPs on its homepage as soon as possible. For example, we plan to prepare a press release that shall be distributed by all alliance partners. It shall ensure broad dissemination all over Europe.

## C) Project details

### 6 Methodology

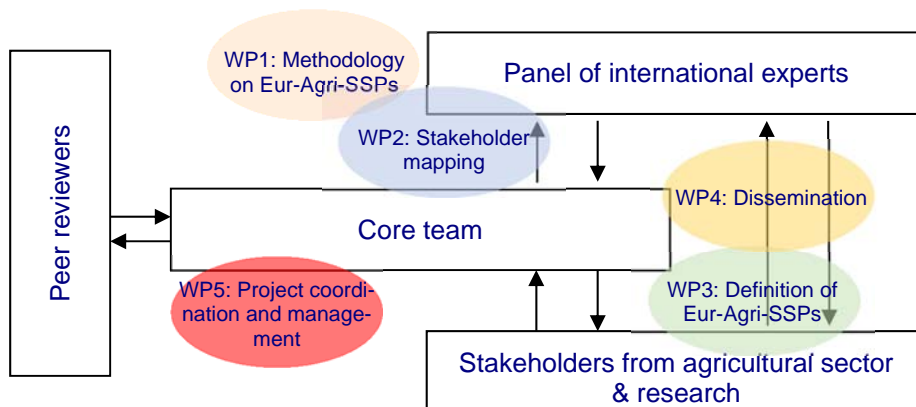
Chapter 3 highlights the needs for Eur-Agri-SSPs and the particular development process. Integrated modelers and qualitative researchers require high resolution storylines consistent with the SSP framework. Resolution here refers to the sectorial (e.g. agriculture) and spatial resolution (e.g. continental to regional level). Typically, this group works with climate change scenarios based on RCPs and depends on information of large scale modelling studies on socio-economic processes such as provided by SSPs. Downscaling SSPs to meaningful parameters (here storyline elements) is crucial but elaborated processes are too demanding for single research projects. This motivated the research alliance on Eur-Agri-SSPs. Besides, there is knowledge demand by the wider public on potential futures in the agricultural sector. Eur-Agri-SSPs shall cover this demand as well.

We have chosen a qualitative participatory process in order to be consistent with the SSPs. This “vertical” consistency was one of the major design criteria along with horizontal consistency and plausibility, richness and creativity, and salience. We strictly followed a protocol in order to ensure transparency and reproducibility. This process is described in detail in the open access publication Mitter et al., 2019. A protocol to develop Shared Socio-economic Pathways for European agriculture. *Journal of Environmental Management* 252, 109701.

<https://doi.org/10.1016/j.jenvman.2019.109701>.

### 7 Working plan and schedule

RAPs.AT had five work packages and was governed by WP5 “Project coordination and management”. RAPs.AT developed a methodology for storyline design (WP1) in a joint process at the level of the Eur-Agri-SSP research alliance. Stakeholder work was fundamental in many process steps. However, WP2 collected and mapped stakeholders to allow a purposeful selection of key stakeholders mainly to support the design of storyline elements (via interviews) and review and validation. The definition of the Eur-Agri-SSPs was achieved in WP3. Dissemination of project results was coordinated in WP4.



**Figure 4: RAPs.AT working plan overview**

Table 1 shows the major milestones of the project. Some have been cancelled during the project. The milestones in RAPs.AT have been:

- M1.1 Student workshop on storyline definition
- M1.2 Working paper on the definition of a methodology to develop regional Eur-Agri-SSPs
- M2.1 Detailed map on stakeholders of the Austrian agricultural sector is available
- M3.1 Storylines and narratives for Eur-Agri-SSPs available
- M3.3 Working paper on Eur-Agri-SSPs available
- M4.1 Manuscript to be submitted to a data journal
- M4.2 Policy summary developed and distributed to stakeholders within and outside RAPs.AT (pending)
- M4.3 Website on RAPs launched
- M5.1 Kick-Off meeting organized and finished
- M5.2 Links to responsible AgMIP and MACSUR researchers established
- M5.3 Final meeting organized and finished

**Table 1: GANTT chart with major milestones**

Work package	month																																																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37												
WP1: Methodology on RAPs	[Orange bars]																										M1.2	[Empty]										M1.1	[Empty]										
WP2: Stakeholder mapping	[Empty]			[Blue bars]														M2.1	[Empty]																														
WP3: Definition of RAPs	[Empty]										[Yellow bars]																	M3.1	[Empty]										M3.3										
WP4: Dissemination	[Empty]																	[Green bars]																				M4.3	[Empty]										M4.1
WP5: Project coordination and management	M5.1	M5.2	[Blue bars]																																		M5.3	[Empty]											

## 8 Publications and dissemination activities

### Papers and manuscripts

Mitter, H., Techen, A.-K., Sinabell, F., Helming, K., Kok, K., Priess, J.A., Schmid, E., Bodirsky, B.L., Holman, I., Lehtonen, H., Leip, A., Le Mouël, C., Mathijs, E., Mehdi, B., Michetti, M., Mittenzwei, K., Mora, O., Øygarden, L., Reidsma, P., Schaldach, R., Schönhart, M., 2019. A protocol to develop Shared Socio-economic Pathways for European agriculture. *Journal of Environmental Management* 252, 109701. <https://doi.org/10.1016/j.jenvman.2019.109701>.

Mitter, H., Techen, A.-K., Sinabell, F., Helming, K., Kok, K., Priess, J.A., Schmid, E., Bodirsky, B.L., Holman, I., Lehtonen, H., Leip, A., Le Mouël, C., Mathijs, E., Mehdi, B., Michetti, M., Mittenzwei, K., Mora, O., Øygarden, L., Reidsma, P., Schaldach, R., Schönhart, M., 2019. Protocol-based development of Shared Socio-economic Pathways for European agriculture: the Eur-Agri-SSPs. (unpublished manuscript).

### Reports and articles in magazines

Sinabell, F., 2019, Spannungsfeld Landwirtschaft und Klimawandel. *Netzwerk Zukunftsraum Land*, 1/2019, Interview mit Susanne Schönhart.

Sinabell, F., 2019, Analyse der Agrarmärkte: Perspektiven für die heimische Land- und Ernährungswirtschaft. *Tagungsband der 25. Wintertagung vom 31. Jänner bis 1. Februar 2019, Aigen im Ennstal*.

### Conference presentations

Mitter, H., Schönhart, M., Sinabell, F., Schmid, E., 2017. Entwicklung und Nutzen von Repräsentativen Landwirtschaftlichen Pfaden (RAPs) zur Unterstützung der Klimawandelforschung in Österreich. 18. Österreichischer Klimatag, 23. Mai 2017, Wien.

Mitter, H., M. Schönhart, F. Sinabell, A. Techen, K. Helming, B. Bodirsky, I. Holman, K. Kok, H. Lehtonen, A. Leip, H. Lotze-Campen, E. Mathijs, B. Mehdi, M. Michetti, K. Mittenzwei, L. Øygarden, J. Priess, P. Reidsma, R. Schaldach, E. Schmid, H. Webber, 2018. *AgMIPWorkshop*, April 24-26 2018, San José, Costa Rica.

Mitter, H., M. Schönhart, F. Sinabell, A. Techen, K. Helming, B. Bodirsky, I. Holman, K. Kok, H. Lehtonen, A. Leip, H. Lotze-Campen, E. Mathijs, B. Mehdi, M. Michetti, K. Mittenzwei, L. Øygarden, J. Priess, P. Reidsma, R. Schaldach, E. Schmid, H. Webber, 2018. Protocol-based storylines for integrated assessments of future European agriculture. *Annual Conference of the Austrian Society of Agricultural Economics*, 27 – 28 September 2018, Vienna.

Mitter, H., A. Techen, F. Sinabell, K. Helming, B. Bodirsky, I. Holman, K. Kok, H. Lehtonen, A. Leip, Le Mouel, C., H. Lotze-Campen, E. Mathijs, B. Mehdi, M. Michetti, K. Mittenzwei, O. Mora, L. Øygarden, J. Priess, P. Reidsma, R. Schaldach, E. Schmid, H. Webber, M. Schönhart, 2019. Protocol-based development of storylines for future European agriculture: Eur-Agri-SSPs. Scenarios Forum 2019. Forum on Scenarios for Climate and Societal Futures, 11-13 March 2019, Denver, Colorado.

Mitter, H., A. Techen, F. Sinabell, K. Helming, B. Bodirsky, I. Holman, K. Kok, H. Lehtonen, A. Leip, Le Mouel, C., H. Lotze-Campen, E. Mathijs, B. Mehdi, M. Michetti, K. Mittenzwei, O. Mora, L. Øygarden, J. Priess, P. Reidsma, R. Schaldach, E. Schmid, H. Webber, M. Schönhart, 2019. Developing protocol-based storylines of future European agriculture to support climate change research. ECCA 2019, 28-31 May 2019, Lisbon.

Schönhart, M. 2019. Landverbrauch durch Technologie ersetzen – neueste Entwicklungen und Zukunftsmodelle. ÖGE Jahrestagung 14 – 15 November 2019, Vienna. (forthcoming)

### **Poster presentations**

Mitter, H., Sinabell, F., Schmid, E., Bodirsky, B.L., Helming, K., Techen, A.-K., Schönhart, M., 2018. Storylines for European agriculture to support integrated assessments. Poster presented at Landscape 2018, 12-16 March 2018, Berlin.

Schönhart, M., Mitter, H., Sinabell, F., Schmid, E. (2017). Representative Agricultural Pathways (RAPs) for Austria: conceptual thoughts on its demand and stakeholder-driven development. Poster presented at the conference on "Climate Action in Agriculture and Forestry". 1 June 2017, Brussels.

Schönhart, M., H. Mitter, F. Sinabell, E. Schmid (2017) Representative Agricultural Pathways (RAPs) for Austria: conceptual thoughts on its demand and stakeholder-driven development. Poster presented at the MACSUR Science Conference 2017, 22-24 May, 2017, Berlin, Germany.

### **Presentations at stakeholder events**

Sinabell, F., 2019, Analyse der Agrarmärkte: Perspektiven für die heimische Land- und Ernährungswirtschaft. 25. Wintertagung vom 31. Jänner bis 1. Februar 2019, Aigen im Ennstal.

Sinabell, F., 2018, EU-Agricultural Policy Reform Challenges for Producers. ELO General Assembly, 5 June 2018, Vienna.

Sinabell, F., 2018, EU-Agrarpolitik – Mehrwert der Landwirtschaft. Ik Klartext kompakt, Landwirtschaftskammer Österreich, Wien.



### **Workshops**

RAPs.AT session at the FACCE MACSUR workshop for policymakers 2017, 11 May 2017, Brussels.

RAPs.AT workshop at BOKU University with interested land use modellers from University of Vienna and the International Institute for Applied Systems Analysis (IIASA), 10 August 2017, Vienna.

Workshop on “Storylines for European agriculture” at Landscape 2018 Conference, 16 March 2018, Berlin.

Participation at the Workshop “Zukunftsbild Digitales Österreich 2040 - 2050” initiated by the Austrian Federal Ministry of Digital and Economic Affairs. 22 – 23 August 2018, Krems.

Eur-Agri-SSP workshop “EUR-AGRI-SSPs: Narrative zur Zukunft der europäischen Landwirtschaft” at the Annual Conference of the Austrian Society of Agricultural Economics, 27 – 28 September 2018, Vienna.

Eur-Agri-SSPs 2-day stakeholder and research alliance workshop “Shared Socio-economic Pathways for European agriculture: Eur-Agri-SSPs”

Eur-Agri-SSPs session “150N: Scenario narratives for agriculture and land systems across scales and locations” at the 4th Open Science Meeting of the Global Land Programme. April 24-26, 2019 Bern.

Masterclass „The future of European agricultural soil management“ at the Wageningen Soil Conference „Understanding soil functions“, 27–30 August 2019, Wageningen, The Netherlands.

### **Courses and seminars**

Global TOA-MD Modeling Course by Roberto Valdivia, University of Natural Resources and Life Sciences, Vienna, 26th November 2018 – 8th February 2019.

Public Seminar organized as part of the research project RAPs.AT, held by Roberto Valdivia, Oregon State University on “New Methods to Assess Climate Change Impacts, Vulnerability and Adaptation of Agricultural Production Systems: The experience of AgMIP Regional Integrated Assessments in Sub-Saharan Africa and South Asia, 5 February 2019, Vienna.

### **Working material**

Guidelines for stakeholder interviews

### **Project homepage**

[Eur-agri-ssps.boku.ac.at](http://Eur-agri-ssps.boku.ac.at)

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