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NACHHALTIGES LANDMANAGEMENT

Interdependencies between Land Use and Climate Change

Strategies for a Sustainable Land Use Management in Germany

Progress Report

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1 Executive Summary

In this report we summarize the activities and first results of the collaborative project CC-LandStraD "Interdependencies between Land Use and Climate Change – Strategies for a Sustainable Land Use Management in Germany" within the BMBF-funding measure "Sustainable Land Management" for the period 10/2010 to 4/2012. The background of the proposed analysis, the selection of the study region and specific tasks are not repeated because they did not change in comparison to the proposal. The report was shifted from February to January 2012 due to the very short schedule of the interim evaluation. During the work period 10/2010 to 1/2012 we progressed substantially to achieve the overall objective, i.e., *to evaluate the mitigation and adaptation potential of various land management strategies across the major land using sectors area-wide in Germany in order to develop sustainable land management strategies in close collaboration with stakeholders taking the feasibility and social acceptability into account.* This report focus' on the major issues during the last period: the stakeholder process, the development of the scenario concept, the framework of assessment, the integrated modeling and the description of the status-quo.

A major and challenging task was to launch the stakeholder process on both the national level and in two selected focus regions. Due to the wide experiences of the team members involved, the reputation of the CC-LandStraD partners as a whole, and our coordinated strategy, we succeeded in activating stakeholders of the relevant supreme and subordinate authorities, and relevant NGOs, both on the federal level and in the states (Länder) of the focus regions. In the state of North-Rhine Westphalia it is expected that CC-LandStraD will continue to support the identification and assessment of suitable measures in regard to the Climate Mitigation Act adopted in 2011. A detailed list of expected results that may help to support the decision-making in the field of land use and climate change was prepared for the authorities of the state of Saxony-Anhalt.

The development of a scenario concept was a further central task in the starting phase of the project. This was simultaneously elaborated to the stakeholder processes. The parallel course of both processes allowed for mutual enhancement. The scenario concept proposed by the CC-LandStraD expert team provided, on the one hand, a basis for discussion, and on the other hand, could already be commented upon and amended by stakeholders. The result is a scenario framework that combines cross-sectoral land use issues in Germany (i.e., settlement, transport, agriculture, forestry, environment and nature conservation aspects) with interdisciplinary modeling issues including alternative global developments provided by GLUES. The considerable effort spent on the scenario concept paid off because it is appreciated within a transdisciplinary dialogue with stakeholders – a prerequisite for the successful progress of the project.

In addition, a catalogue of suitable land management measures, partly suggested by stakeholders, was compiled as fact sheets. The measures address the potential contributions of

land use to climate change mitigation, renewable energy production from biomass, environment and nature conservation, as well as adaptation to climate change. Each of these issues represents a land use strategy that will be assessed in view of its trade offs. Therefore, we developed a framework of assessment that is coherent to the scenario concept and aligned with potential results and indicators of the integrated modeling.

In order to provide a basis for the scenario concept, the project team devoted great effort to the development of an original and comprehensive description of status quo of the sectors relevant to land use in Germany (i.e., settlement, transport, agriculture, forestry, environment and nature conservation aspects). This description serves three purposes: (1) a concise presentation of land use in the context of its drivers, climate change and the corresponding interdependencies; (2) background knowledge for the development of the scenario concept; (3) and ultimately as the written scientific basis for CC-LandStraD and stakeholders in the form of an extensive background paper.

The work on the further development of the interdisciplinary models and their integration via interfaces progressed almost as planned in the proposal. Interim delays due to initial problems in recruiting qualified staff in some modeling sub-projects could be compensated because ultimately the positions were filled with experienced post docs. The CC-LandStraD consortium now consists of a well-balanced team of senior scientists, experienced post docs and post graduates. Our dialogue and working atmosphere is positive and prolific.

The coordination project and several sub-projects brought valuable inputs into several activities of the funding measure. The cooperation and data exchange with GLUES and with Module B projects show the strong involvement of CC-LandStraD within the funding measure (Module A and Module B).

The activities of the first project stage promise fruitful preliminary results for the further progress of the project. So far there are no adaptations of the work plan as compared to the proposal.

2 Overview of the Results in Comparison to the Call

2.1 Stakeholder Participation

At the heart of CC-LandStraD is the participation of stakeholders throughout the entire project. The involvement of different land use and land management actors is realized via different modes and forms of action on two different levels: the national level (Section 2.1.1) and a regional level (Section 2.1.2). Activities up to now with regard to the national and regional stakeholder processes are summarized in Deliverables C 5.1 and C 5.2.

2.1.1 Stakeholder Participation on National Level

The sub-project "Stakeholder participation on national level" pursues two distinct objectives. First, it wants to contribute to the social-science debate on climate change by analyzing major actors of land management and land use change in all relevant land use sectors in Germany. The research focuses on their perceptions and interpretations of climate change, perceived and expected impacts of climate change on land use, mitigation and adaptation strategies as well as further climate change-related activities in the different sectors. Second, the sub-project develops a methodology to be applied for the participation of national stakeholders throughout the project. Through such involvement CC-LandStraD wants to ensure that major land use demands and interests in Germany, and those interactions between land use and climate change as well as between different land use strategies are considered in the project's endeavors.

For the participatory process on the national level, 'stakeholder' means *all relevant actors organized on a national (federal) level who have a (semi-)professional interest in land use, impact on land use and/or represent actors that are affected by land use change.* These include political bodies, authorities and NGOs from all main land use sectors in Germany, particularly from agriculture, forestry, settlement and nature protection. Further land use sectors (such as energy production, the water sector or tourism) are also taken into consideration and, depending upon upcoming project scenarios and results, might become more important in the future course of the project.

An in-depth literature analysis, supplemented by Internet searches, revealed more than 30 stakeholders from policy and authorities and about 100 NGOs. Further stakeholders included representatives, for example, from international boards or the insurance industry. Thus, in a first step, altogether 147 organized stakeholders were identified. In a second step, this number was reduced by restricting the selection to those stakeholders considered as most important from the perspective of the project's research interests. To this aim, a survey within the consortium was conducted which finally led to the selection of 62 relevant stakeholders in the field of land use and land management on the national level in Germany.

Stakeholder involvement in the project is realized in different ways: through interactive workshops (both cross-sectoral and focusing on just one sector); through semi-structured interviews (see Chapter 3.1 below), by providing stakeholders with information material (e.g., project flyer and newsletters) and preliminary results as well as through informal feedback (e.g., via e-mail or phone). The 40 most relevant stakeholders were invited to an informative workshop in Berlin in June 2011. Also, first face-to-face interviews were conducted (see Chapter 3.1). This continuous interactive procedure contributes to shared problem definitions and mutual learning. As not all stakeholders can be involved in the same way in all steps of the project, these different modes of involvement allow for dis-

semination of intermediate results among a wide range of stakeholders (see Deliverable C 3.1).

The participatory methodology applied is innovative as it involves stakeholders from the very beginning of the research. Moreover, it includes representatives from all major land use sectors. At this time, climate change discourses on mitigation and adaptation are highly segregated by the different sectors. Particularly the exchange between agriculture and forestry on the one hand and the settlement sector on the other has to date been rather limited. Moreover, this approach is not only transdisciplinary but also interdisciplinary as it requires a continuous translation of project findings from rather distinct disciplines into a language comprehensive to the different stakeholders. Not least, it facilitates the interdisciplinary discourse within the consortium.

2.1.2 Stakeholder Participation on Regional Level

The regional stakeholder participation process in the two focus regions Altmark and Rhine is an interface for the transdisciplinary and integrated research process in CC-LandStraD. This process allows for the necessary adjustment of scientifically identified land use strategies with actual land use problems and an assessment of their sustainability from a stakeholder point of view.

The regional stakeholder participation process assesses the likelihood of implementation of the proposed land use strategies in both focus regions. The acceptance of these strategies will be studied by means of a stakeholder assessment. With respect to the transferability of the project's results to other regions, two focus regions with very different land use characteristics were selected. It is therefore ensured that an as large as possible range of land use strategies will be assessed through stakeholder participation in order to identify land use strategies that are likely to be relevant in regions other than the focus regions.

The dialogue between science and practice that is aspired with CC-LandStraD will be realized by means of the regional stakeholder participation process. Stakeholders were identified who possess relevant expertise to support the stakeholder process. The procedure to identify relevant regional stakeholders consisted of an iterative process. Identification and selection of regional stakeholders are described in detail in Deliverable F 1.2.

In the starting phase, a constructive relationship has already been established in the focus regions, An essential contribution for that to happen, was the presentation of the project in both focus regions by the project coordination (vTI) in cooperation with sub-project 6 (ZALF). The supreme authorities in North Rhine Westphalia explicitly appreciated the work of CC-LandStraD as the federal state just adopted a climate mitigation act. It is expected that CC-LandStraD contributes valuable input with regard to a planned process of public consultations and the choice of suitable climate mitigation measures. After the

presentation in the “Altmark,” a detailed list of the results that CC-LandStraD can contribute to the decision making in the field of climate change and land use was agreed upon with the competent authorities in Saxony-Anhalt. The kick-off presentations in both regions were followed by 46 local expert interviews in order to assess regional land use challenges as well as land use-related expectations and preferences of stakeholders in the focus regions. Thereby, a foundation for the transdisciplinary knowledge exchange between science and practice was established, upon which will be built during the course of the project.

Details of the procedure of the regional stakeholder process and the already generated results are laid down in Deliverable C 3.1. The characteristics and selection criteria for both case study regions are outlined in the joined Deliverable S 2.1 and S 3.1. Available results and the analysis of the expert interviews with respect to land use problems, land use preferences and the stakeholders’ views on the interplay of climate change and adaptation as well as the already adopted measures for climate change mitigation and adaptation, are to be found in Deliverable F 1.2.

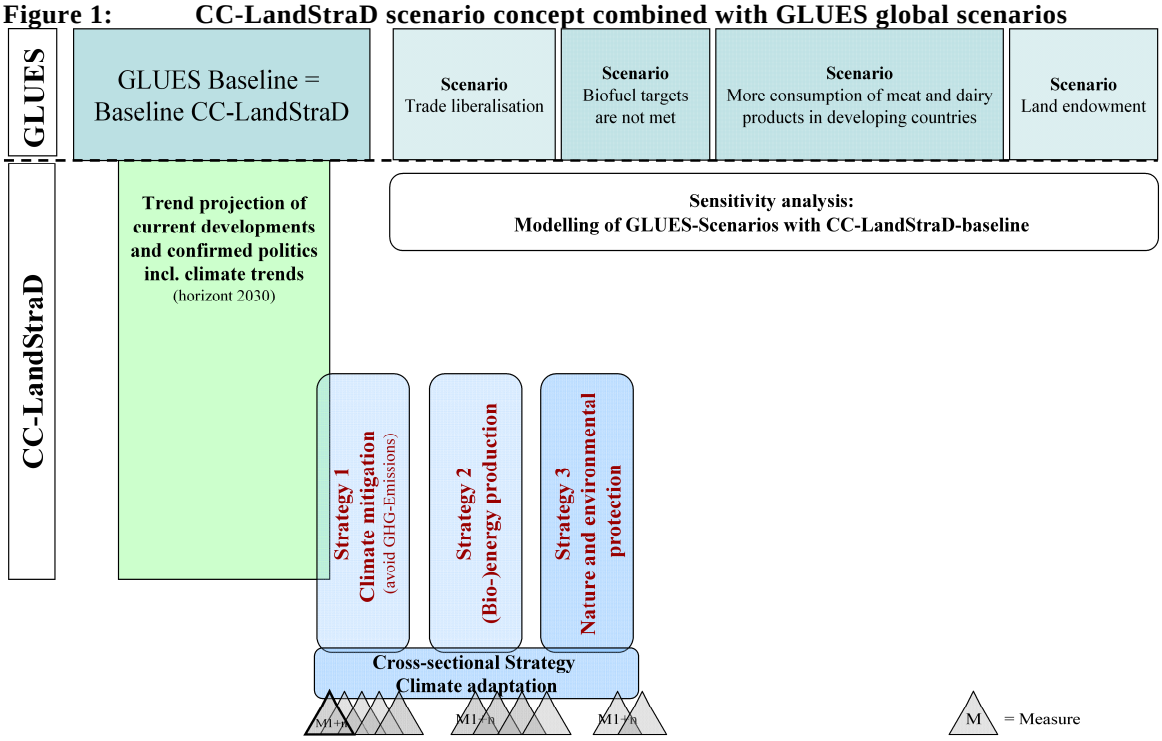
2.2 Scenarios, Strategies and Socio-economic Frame Conditions

The development of scenarios and strategies is a continuous process in CC-LandStraD, begun at the kick-off meeting in January 2011, deepened in a scenario workshop in April 2011 and consolidated during the annual meeting in November 2011. Due to the early and in-depth discussion about the scenario design we could already provide valuable comments to the global scenarios on the scenario workshop held by GLUES in May 2011. The process of aligning scenarios proceeded in the following months, especially with the GLUES sub-project “Global Models and Scenarios.” In June 2011, a first draft of the scenario concept was presented at the informative stakeholder workshop that introduced the national stakeholder process of CC-LandStraD. The scenarios were positively received. In the subsequent interviews with national stakeholders (though still in the process of analysis) in the final months of 2011, the consortium received positive feedbacks to these scenarios by the stakeholders. In addition we discussed initial adjustments of scenarios with the project NaLaMa-nT (Module B) in October 2011 that developed similar scenarios.

In the light of the positive feedback we took the comments of stakeholders into account and developed the concept of scenarios further. The project is methodologically based on a comparative-static analysis. In CC-LandStraD this implies that the impacts, derived for the target year 2030, of both alternative global development scenarios, e.g., trade liberalization, varying demand for agricultural produce (food or bio-fuel) or land endowment and measures that will be combined to land use strategies are compared versus a reference situation (see Figure 1). Because the reference situation (baseline) plays a key role, between GLUES and CC-LandStraD are in agreement that a consistent baseline for Germany will be thoroughly developed in an iterative procedure.

To begin with we initiated first steps to achieve a consistent baseline across the major land using sectors in Germany. In particular we compiled a detailed description of the current situation and challenges of land use and the related ecosystem services and merged available projection information (see Deliverable S 2.1/S 3.1). In this context we could resort to the ongoing model-based analysis of work groups, specifically at BBSR and the vTI, that elaborate mid-term projections of settlement and transport areas until 2030 and the agricultural sector until 2021, respectively. These well established baseline projections are periodically updated and used for policy analyses that support the decision making in the responsible federal ministries.

Figure 1: CC-LandStraD scenario concept combined with GLUES global scenarios



Source: Own illustration.

The task to be tackled in the following months is to harmonize assumptions, e.g., economic growth or population development, time horizons (uniformly to the target year 2030; compatible to GLUES mid-term scenarios) and specific data bases. This requires coordination between the involved expert groups and will be accomplished within the process of integrating the interdisciplinary models via interfaces (see Deliverable C 3.2). The consistent baseline for Germany that will integrate the comprehensive expert information into the global modeling will then be provided to GLUES. Adjustments of global driving forces, such as agricultural prices that may potentially result, will be returned to CC-LandStraD. The project office will then align the baseline for Germany accordingly. The final baseline establishes the reference scenario for the above mentioned alternative global development scenarios of which each addresses an important driving force Figure 1). GLUES results for these scenarios are scheduled to be available by 2013. Analogous

to the baseline, CC-LandStraD will regionalize the impacts of global scenarios for Germany and provide the results to interested projects, e.g., in Module B (see Section 2.7 Collaboration). The results reflect the spectrum of the uncertainties of prospective land use developments and their ecosystem services and present projections that should not be understood as predictions.

The specification of strategies in CC-LandStraD addresses four societal requirements of the land use that have become more important in the last years and decades. These are (1) the contribution of land use to climate mitigation, (2) the potential of biomass production for bio-energy generation, (3) nature and environmentally-sensitive land management and (4) adaptation to climate change that affects each of the first three issues. The stakeholders appreciated the idea of operationalizing these topics within strategies because the setting permits the impacts on land use and ecosystem services to be juxtaposed such that trade offs between the strategies can be highlighted.

Land management measures and policy options that would support at least one of the objectives mentioned above were surveyed in a comprehensive literature review. They were cross-checked with statements from stakeholders in regard to effective measures from their perspective. A consolidated interim catalogue of fact sheets of measures and options that fall within the scope of CC-LandStraD are presented in Chapter 6 of Deliverable S 2.1/S 3.1. While a few measures will contribute to more than one aim, there are also measures which will inevitably lead to conflicts between the objectives. In a first step the impacts of measures on land use and ecosystem services will be analyzed separately. In a second step they will be assigned to the indicated strategies subject to their main contribution in order to estimate the aggregated impact of the measure bundle which is expected to differ from the sum of impacts of single measures.

Climate change influences land use such that the measures, especially those with a long-term perspective, in particular in forestry and also in settlements or the transport sector, will be analyzed and evaluated regarding their vulnerability to climate change. Since the majority of stakeholders are interested in developments until the target year 2030 the scenario analyses focus on the medium range scale. This refers to the baseline as well as the outlined alternative land use strategies. All medium range scenario analyses will be carried out according to the procedures outlined for the AR5 (Assessment Report 5) of the IPCC. The development of climate change will be regarded as independent of socio-economic and political developments. This implies that different socio-economic and political pathways might lead to the same climate change responses. In consequence, not all possible realities which result from obviously existent multiple causal linkages between socio-economic and land use change will be assessed. This means in turn that different land use strategies do not feed back to the employed climate change scenarios.

In agreement with the GLUES project, medium range climate projections up to 2030 will be in accordance with an increase of atmospheric forcing of about 8.5 W/m^{-2}. This re-

flects the current emission pathway. According to the most recent climate simulations of ECHAM6 within the CMIP5-programs this would lead to an average temperature increase of 1.2 K from 2010 to 2060 in Germany.

In addition to the AR5 approach of energy-driven climate pathways, so called representative concentration pathways (RCPs), CC-LandStraD will assess temperature stratified scenarios. Individual climate scenarios differ in their magnitude of temperature increase, which are scaled to half- and full-degree temperature changes. They expand the period under consideration beyond 2030, however, the actual year in which the predicted temperature change is reached is not needed to be necessarily specified. However, the development of the climate may not be regarded independently of the underlying atmospheric CO_2 concentrations, as they might substantially modify the partial climate development. Further details are thoroughly presented in Deliverable M 1.1.

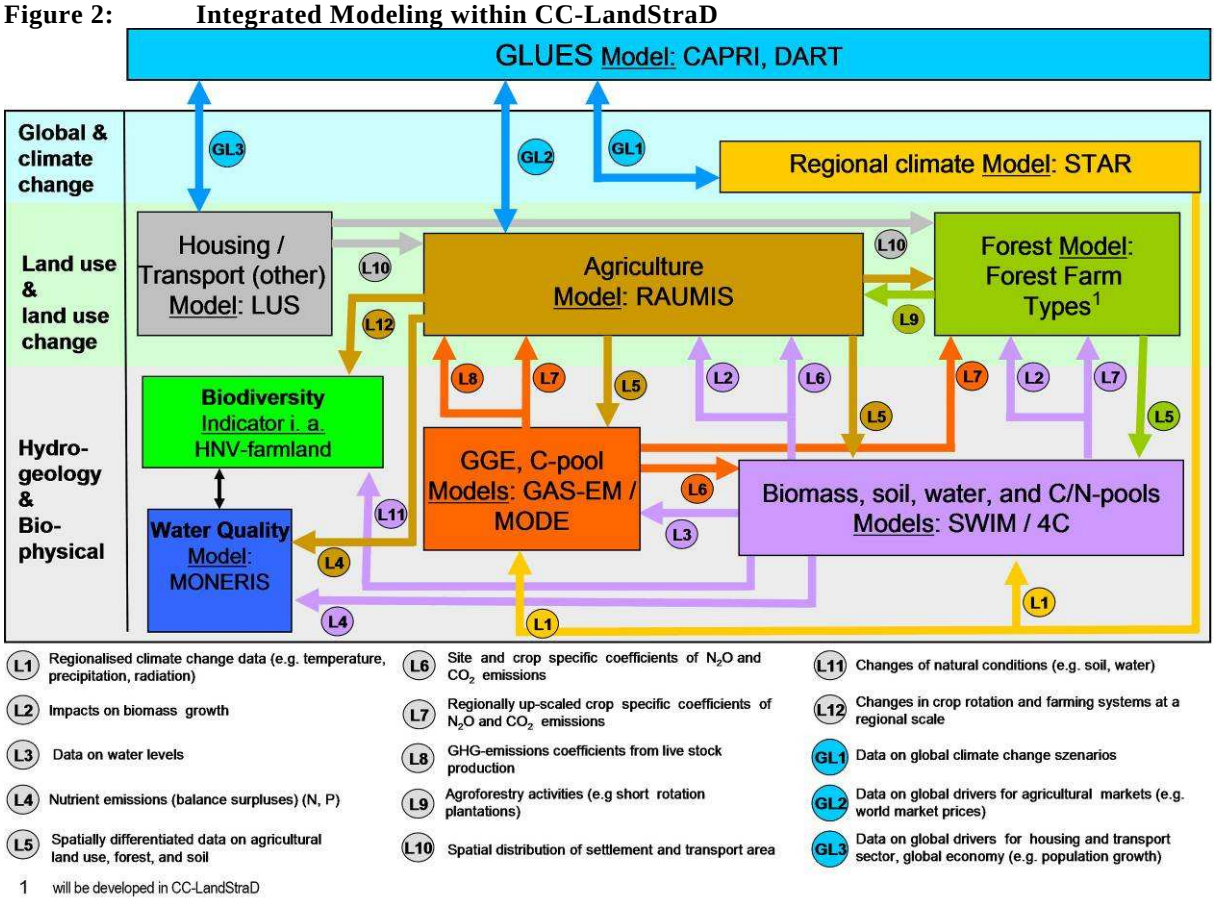
As a cornerstone for the modeling work a reference climate data set was compiled for the period of 1901-2010. A range of temperature stratified climate change scenarios are available for the climate change projections and sensitivity studies,. Both products allow for area-wide and spatially high resolution simulations of landscape processes which were not possible in such a way until now.

In the starting phase of project, CC-LandStraD made substantial efforts to develop a scenario concept including a set of measures. This was necessary since the scenario design constitutes an important basis for aligning the modeling and the assessment of impacts of alternative measures and strategies. Furthermore, the achieved acceptance of the scenario approach by stakeholders was crucial in order to sustain the transdisciplinary discourse at a high level throughout the project. The consensus is a prerequisite in regard to the appraisal of project results and the confidence to derive recommendations on this basis.

2.3 Integrated Modeling

This section describes the progress in the field of integrated modeling, i.e., developing models and establishing interfaces Additional information is provided in Deliverable C 3.2. Figure 2 gives an overview of the integrated modeling. First we describe natural processes between climate, soil, water, GHG emissions and land use and then socioeconomic land use models.

Figure 2: Integrated Modeling within CC-LandStraD



Source: Own illustration.

2.3.1 Modeling Natural Processes

The aim of the sub-project “Area-wide analysis of land use change in Germany and its consequences for the land water, carbon and nitrogen household” is to carry out Germany-wide simulations of water and matter fluxes that are inputs to the other models (see Figure 2). The natural boundary conditions for the baseline and alternative scenarios are provided. During the first phase of the project, the thus necessary interplay of the models SWIM and 4C were studied as examples. An essential precondition was the assembly of a Germany-wide data base consisting of climate, land use and forest data for the reference period. The model coordination process started and will be continued with the model parameterization. The first ensemble simulation experiments were carried out exemplarily in the Elbe river basin due to data availability, technical affordability and manageability. The periods covered were the recent past as well as the immediate future. Deliverables M 2.1 and M 2.2 show first results.

The process-based basics of the models SWIM and 4C allowed a mutual plausibility assessment. General eco-hydrological variables such as net-primary productivity and water and matter balance parameters were used. In collaboration with the project partners at

vTI-AK and vTI-OEF next steps were planned and discussed. With vTI-AK it was agreed to initially support their planned GHG emissions calculations by providing the climate-dependent boundary conditions (Figure 2: L3) and to later implement their GHG-emission algorithms into the eco-hydrological modeling framework (Figure 2: L6). With vTI-OEF the deliverable of climate-response-functions for tree-species productivity (Figure 2: L2) was agreed upon to provide for a consistent account of climate impact in their further calculations. The simulations will greatly improve in their spatial resolution as well as in the coherence between assessed sub-processes in comparison to past modeling studies. A substantial improvement in simulation quality seems unaltered realistic.

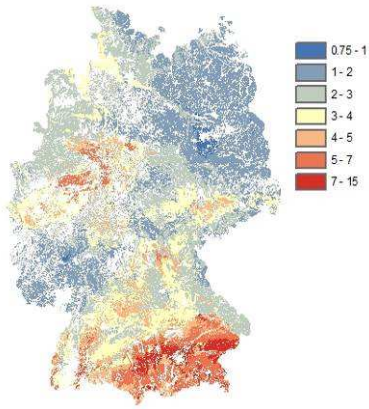
The sub-project „Modeling impacts of land management on GHG emissions from German agriculture and forestry" develops model approaches to simulate GHG fluxes of the sectors agriculture and land use. In the starting phase of the project, the modeling focused as scheduled on the development and modification of model approaches for simulating N_2O and CH_4 emissions of mineral soils. Nitrous oxide emissions of mineral soils contribute significantly (about 40 %) to the GHG emissions of the sectors agriculture and land use/land use change in the German national GHG inventory (Deliverable S 2.1).

To assess the impact of land use strategies on GHG emissions methods are needed that allow a quantification of GHG in response to natural conditions and management practices on a national scale. Statistical model approaches[1] have been developed using representative data sets of measured N_2O emissions. These models allow a spatially explicit modeling of nitrous oxide emissions of land use systems and related model uncertainties. Based on meta analyses from literature reviews, methods were developed to account for several management options (e.g., type of nitrogen fertilizer, fertilization practice, nitrification inhibitors). Emission factor maps were derived from model regionalization on a national scale. First results are displayed in Chart 1 and will be finished by April 2012.

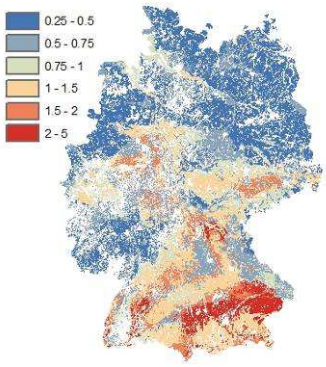
Emission factor maps will be derived for the time period of planned scenarios using climate scenarios of the STAR model (Work package M1). These maps will be used in the agro-economic and biophysical models of Work package M2 and M4 which enables them to simulate on the run-respective GHG emissions (Figure 2: L6 and L7). Developed models were also implemented in a temporal GIS environment to facilitate the transfer of input and output data with other models of the project and to improve the assessment of model results (spatiotemporal queries, aggregation, disaggregation, and visualization). Similar methods to simulate CH_4 emissions of mineral soils will be developed until April 2012.

[1] Model approach: MODE (model ensembles of fuzzy logic inference schemes)

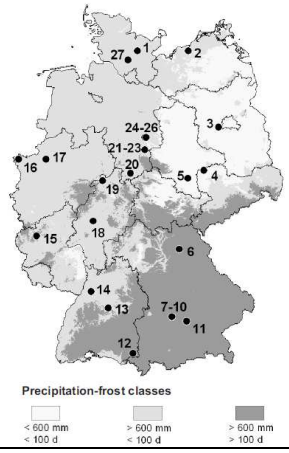
Chart 1: **Regionalized annual N2O emissions and emission-factor maps of German croplands by MODE. For comparison: N2O emission potentials (precipitation-frost classes) with increasing potentials from light to dark grey**



N_2O emissions (mean 1990-2005) [kg N_2O-N ha^{-1}]



N_2O emission factors (mean 1990-2005) [% N-import]



Precipitation-frost classes from Jungkunst et al. (2006)

Source: Dechow R, Freibauer A (2011): Assessment of German nitrous oxide emissions using empirical modeling approaches. Nutrient Cycling in Agroecosystems 91(3), 235-254.

Model approaches for simulating GHG (CO_2, N_2O, CH_4) land use systems on organic soils were developed based on model approaches and methods (MODE, temporal GIS). These are built for the estimation of direct N_2O emissions and a comprehensive data collection of measured N_2O and CH_4, statistical approaches that estimate direct N_2O and CH_4 emissions in response to climate variables, groundwater table height and management. The work is in progress on methods to account for CO_2 emissions.

2.3.2 Socio-economic Modeling

The use of area for settlements and transport is a dominant claim in Germany due to its higher chain of economic value added in comparison to agriculture and forest. Thus we first address the progress achieved in modeling the development of settlement and transport areas (Work package M6) which has multiple impacts on ecosystems. Beside the loss of high-quality soils, mostly at the expense of agricultural areas (see CLC2006; BBR Forschungen 130, 2007), there are numerous indirect impacts of urbanization. Thus, the future development of settlement and transport areas is important for the implementation of mitigation and adaptation measures to achieve a sustainable land management.

The survey and analysis of available data (statistical, cadastral and remote sensing), as required for the land use change modeling, revealed that several high-resolution data sets are available to date. Nevertheless, the modeling task requires special properties of land use data which lead to a combination of two data sets: the DLM-DE 2009 and the GMES Urban Atlas. Detailed results on the analysis will be provided in Deliverable M 6.1.

The land use data represents the initial point for land use change modeling as well as for agricultural and forest economic modeling. Mainly based on data interfaces, several linkages have been established between the land use-related models. The environmental economics model PANTA RHEI REGIO (PRR)[2] provides the demand for settlement and transport areas on regional level. These results serve as input for the cross-sectoral land use change model Land Use Scanner (LUS) that simulates land use changes in a spatially explicit way, and they serve as a framework for the available agricultural land in RAUMIS (Figure 2: L10). In addition, LUS results about area development are input into the eco-hydrological SWIM model. These model linkages have already been established and tested in previous research projects[3]. The linkages between PRR, RAUMIS and LUS are new but easy to establish because all models are able to process data on NUTS-3 level.

PRR estimates future trends of settlement and transport areas econometrically based on past economic, demographic and land use trends. It has been updated and validated from the projection period 2008-2025 to the period 2008-2030. The results of a first trend projection show a further decline in the daily demand for settlement and transport areas. While in current trends the daily demand decreased from 129 ha between 1997 and 2000, to 87 ha between 2007 and 2010, it will be 58 ha in 2020 and 51 ha in 2030. The objective of the sustainability strategy of the Federal Government to reduce the daily demand for settlement and transport areas to 30 ha in 2020 will therefore not be reached. A previous study revealed that only with a strong economic decline will the demand for settlement and transport areas decrease below 50 ha per day in 2020, with all other parameters remaining constant[4]. Furthermore, the settlement development in West Germany concentrates more on the cities and urban areas than on rural areas. But according to current projections, growing regions will continue to grow and stagnating regions continue to stagnate (Chart 2). This results in a polarization of the settlement structure.

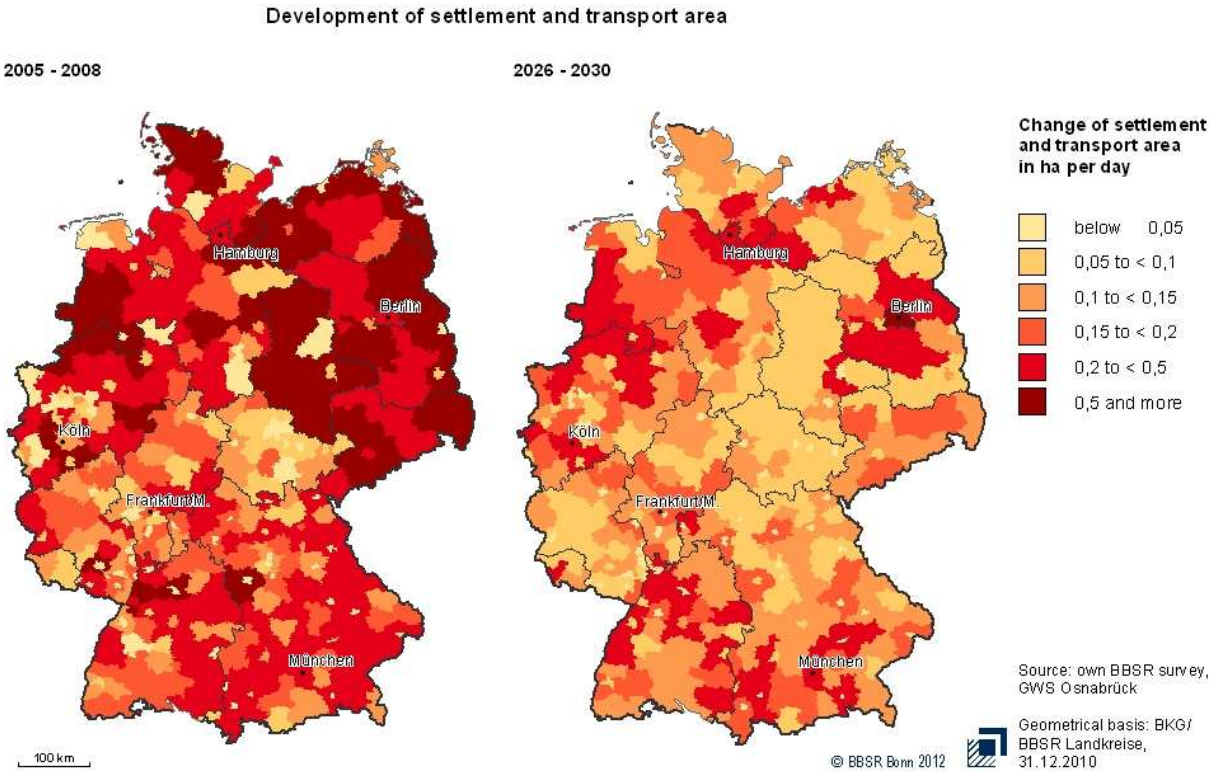
The LUS uses the presented results as an input for a spatially explicit cross-sector simulation of land use changes. The transferability and applicability of the model within a large study area was discussed with other model users and the model developers. Current developments of the model allow a high-resolution simulation for large study areas as well. Nevertheless, spatially explicit and Germany-wide high-resolution modeling of land use changes is innovative. The configuration of the model, including the implementation of mitigation and adaptation measures as well as their climate impact assessment will be established in 2012.

[2] A subcontract was concluded with the GWS Osnabrück, which developed the PRR model.

[3] Within the GLOWA-Elbe project, the model linkages between LUS, RAUMIS and SWIM were established and successfully applied. Instead of the PRR model, another model was used there to project the demand for settlement and transport areas as an input into RAUMIS and LUS.

[4] BMVBS (Bundesministerium für Verkehr, Bau und Stadtentwicklung) (2011): 30-ha-Zieol realisiert. Forschungen Heft 148, Bonn.

Chart 2: Regional development of settlement and transport area in ha per day in Germany, 2005 to 2008 and 2026 to 2030



The task of the regionalized agricultural economic and environmental information system RAUMIS is to model the impacts of alternative global developments (Figure 2: GL2) and different land management systems and measures on agricultural land use, production, income and the environment in Germany. The regional representation of the agricultural sector in RAUMIS is based on NUT3-level regions that are considered as regional farms. Thus updates of base years hinge upon the availability of regional data from the Farm Structure Survey. In the first phase of the project the base year was updated to the year 2007 which includes checks for consistency and calibration procedures. Since December 2011 selected regional results of the Farm Structure Survey of 2010 are available and the base year will be updated again in the next months. The update of the vTI-baseline for the German agricultural sector[5] was an important activity. Selected results are presented in Deliverable S 2.1/S 3.1. The vTI-baseline provides an essential basis for the development of a consistent cross-sectoral baseline in CC-LandStraD until 2030.

[5] Offermann, F., Gömann, H., Kleinhanß, W., Kreins, P., Ledebur, O. von, Osterburg, B., Pelikan, J., Salamon, P., Sanders, J. (2012): vTI-Baseline 2011 - 2021: Agrarökonomische Projektionen für Deutschland. Braunschweig, Landbauforschung vTI agriculture and forestry research - Sonderheft 355, deutsch. (in press)

In regard to an exchange of area between agricultural use and forest (Figure 2: L9) it was planned to implement, e.g., short coppice plantation as a new biomass activity in RAUMIS. However, due to the high transport costs of biomass, the regional allocation of biomass production depends on the construction of biomass power plants. These in turn result from local entrepreneurial decisions that are not represented in RAUMIS. The conclusion of a thorough discussion between vTI-LR and vTI-OEF was that a full integration of such an activity into the RAUMIS framework did not seem appropriate. Rather, RAUMIS will be applied to derive suitable land for afforestation or for short coppice plantations. In scenario simulations the area coverage will be imposed exogenously. Data, e.g., on biomass yields and production costs were collected for the specification of the activity.

In order to further develop the GHG module in RAUMIS, activity-specific emission factors were provided by vTI-AK from the models GasEM (animal production) and MODE (plant production not yet regionally differentiated). The emission factors were applied to the activity levels of RAUMIS to calculate regional GHG emissions. The results were checked for consistency with the National Inventory Reports[6] (see Deliverable M 4.1).

The primary contribution of the “Forestry Modeling” sub-project to the integrated modelling within CC-LandStraD is the further development and application of a simulation model on the economic decision behaviour of forest enterprises. After assessing the available model approaches, the „Strugholtz-Englert-Model“ turned out to be best suited for the present purpose and was selected as a starting point. The „Strugholtz-Englert-Model“ is an economic model which has recently been developed at Göttingen University and is currently being refined at vTI-OEF. It simulates various economic target variables (e.g., net present value) by forest holding category and allows for varying wood prices and harvesting costs. Growth and yield functions derived from empirical yield tables and German sorting conventions are used an input. An interface to the 4C model will be developed in order to combine the economic output provided by this model with the associated material and carbon flows (WP M5.5).

The data base consists of the National Forest Inventory (NFI) and the German Forestry Accountancy Data Network (TBN)[7]. Based on the NFI data and in combination with a geographical information system (ArcGIS), regionalised model forest enterprises are created with their natural production conditions. The entrepreneurial decisions and economic potential will be reproduced by regression analyses of real forest enterprises which participate in the TBN (see Deliverable M 5.2 and Section 3.2.3). Work on the interface between agriculture and forestry (WP M 5.6) is explained above.

[6] Nationaler Inventarbericht zum Deutschen Treibhausgasinventar 1990 - 2009. Hg. v. Umweltbundesamt. Dessau-Roßlau (Climate Change, 11/2011).

[7] TBN conducted by the Federal Ministry of Food, Agriculture and Consumer Protection.

2.4 Assessment

The integrated assessment of land management strategies includes three sections: the first section deals with the assessment of ecosystem services in agricultural land use (IÖW), the second section with the assessment of ecosystem services in forestry (vTI-OEF/2), and in the third section, the status of research in environmental and spatial planning law regarding land use (WWU) is addressed.

CC-LandStraD's scenario concept (Deliverable S 2.1/S 3.1) and the concept for the monetary assessment of impacts on GHG emissions, environment, and ecosystem services (see Deliverable A 2.1) were developed in an intensive iterative process. The almost simultaneous development of both concepts right from the start of the project guarantees the appropriateness of the integrated modeling results for the monetary assessment. A comprehensive inventory of indicators from the interdisciplinary modeling that can be used in the assessment was an important side effect of drafting Deliverable S 2.1/S 3.1. In addition, a few shortcomings were detected at this early stage that will be overcome in the course of the project.

Principally, the monetary assessment is based on the Millennium Ecosystem Assessment (MEA). The MEA concept of ecosystem services allows for an interdisciplinary linkage between the sub-projects - between the social-science view on ecosystems in terms of goods and services from ecosystems and the view of natural scientists on the functional role of biodiversity and ecosystem services. Furthermore, it ensures the transferability of the overall project results far in excess of exemplary strategy implementation in the two focus regions.

Valuation methods are introduced for provisioning and regulating services including market prices and avoidance cost relevant to the assessment subprojects. Supporting services are not considered in the valuation, as they are input for other services and thus integrated in their valuation. Stated Preference-Methods are being used for the valuation of cultural services. Cultural services include, e.g., the perception of aesthetic landscapes, natural plant and animal species, and recreation in the landscape. Relevant indicators to assess land use changes with the named services (e.g., reduced GHG emissions, water storage capacity, production techniques, expected land use changes, reduced nutrients input into ground waters and surface waters) will be considered in the scenarios and verified by the modeling and the assessment sub-projects.

To broaden the empirical study on the assessment approach (regionally, methodologically and analytically), an assessment working group has been established within the CC-LandStraD sub-projects IÖW and vTI-OEF/2 and the relevant sub-project of the Module B project NaLaMa-nt (Technical University Berlin). The group agreed to join forces in preparing, conducting and analyzing interlinked empirical studies. As the results are expected to differ regionally the survey will be conducted all over Germany. Thus citizens' welfare is not only accounted for in terms of the provision of public goods and ser-

vices in agricultural landscapes and forests in general, but also with respect to the different land use types. The monetized benefits of the respective goods and services will be incorporated into cost-benefit analysis. The results will be valuable information to policy makers to evaluate alternative land management systems and measures (see Section 3.3).

The WWU sub-project analyzes and evaluates the existing German statutory and non-statutory system of planning and incentive instruments in the fields of spatial planning, agrarian structure, environmental planning and nature protection. The analyses and evaluation are considered in terms of their ability and potential to implement new forms of a climate change-optimized and sustainable land management (see Section 3.3.3).

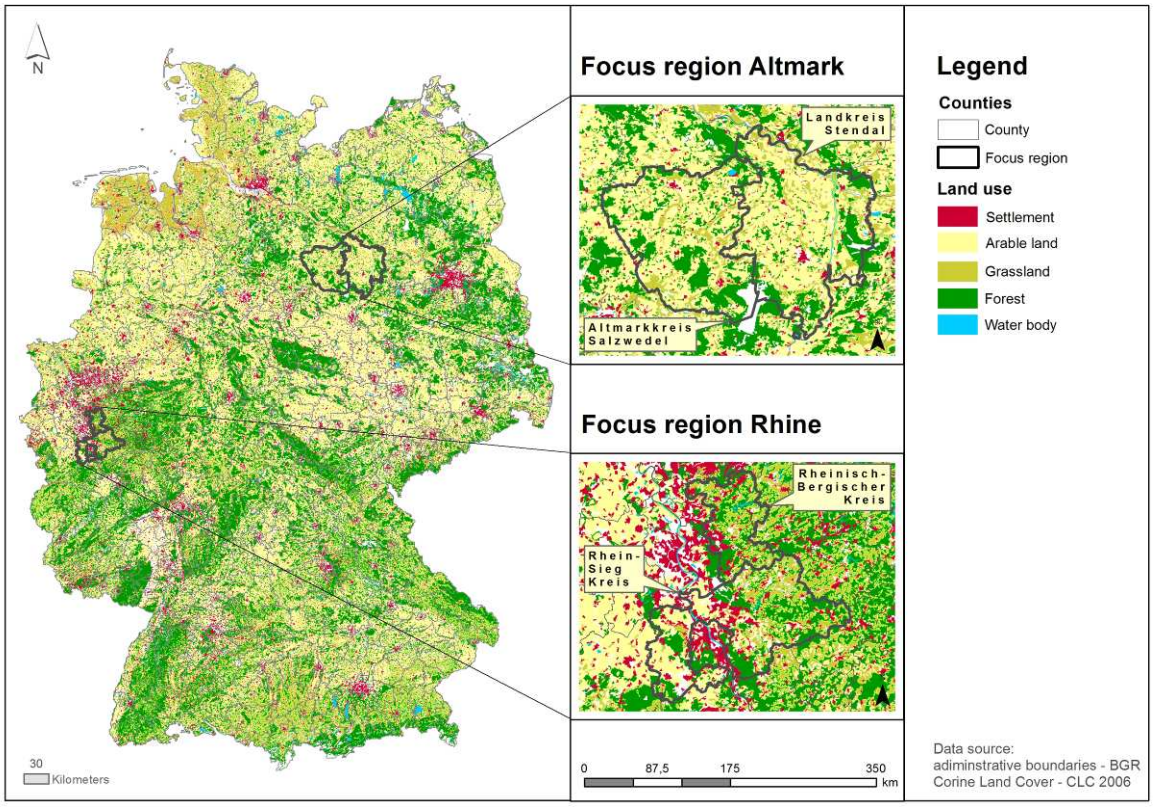
2.5 Investigation Areas

All socioeconomic and bio-physical investigations will be done for Germany. Furthermore, the findings and identified strategies will be discussed in case study regions in the regional participation process. This process allows for the necessary adjustment of scientifically identified land use strategies with actual land use problems, and an assessment of their sustainability from the perspectives of different stakeholders (see Deliverables F 1.2 and C 2.1).

This section gives a brief description of the exploration region Germany and the case study regions Altmark and Rhine and point out the land use conflicts identified so far (Chart 3).

Detailed information about the current situation of land use and the sectoral and cross-sectoral influences and conflicts on land use and climate change in Germany and the focus regions is provided in Deliverables S 2.1/S 3.1 and F 1.2.

Chart 3: Investigation areas in CC-LandStraD



2.5.1 Exploration Region Germany

In Germany, land uses are primarily agriculture (52 %), forestry (30 %) and the sector settlement and transport (14 %). Water bodies and other usages cover around 4 % of land area. The forest area has developed almost constantly since 1992. Settlement and transport areas increased continuously, mostly at the expense of agricultural areas. Agricultural and forest land uses often occur in combination with environmental and nature protection areas (such as Natura 2000). This applies to nearly 10% of the terrestrial area in Germany.

As mentioned in Sections 2.1 and 2.2, the current land use conflicts - sectoral and cross-sectoral - were identified in cooperation with stakeholders and experts of all relevant sectors. They can be summarized as follows (see Deliverable S 2.1/S 3.1):

Sectoral conflicts:

– The objective to reduce the expansion of settlement and transport area causes conflicts with other objectives of the development of the settlement and transport area.

– The competition for limited area to produce food, feed, energy and fiber is steadily increasing.

– In forestry countervailing objectives exist that require an intensification and extensification of forest management at the same time.

Cross-sectoral conflicts were identified between agriculture and settlement/transport (e.g., loss of agricultural land), agriculture/forestry and nature protection (e.g., introduction of utilization restrictions to conserve nature). These conflicts are expected to be aggravated by climate change as well as by adaptation and mitigation measures that need to be implemented.

2.5.2 Case Study Regions

Two German case study regions were selected that each encompass two counties, i.e., the Altmarkkreis Salzwedel and Stendal in Saxony-Anhalt (case study region “Altmark”), on the one hand, and the counties Rhein-Sieg and Rheinisch-Bergisch in North Rhine-Westphalia (case study region “Rhine”), on the other.

The case study regions were selected for their strongly differing population densities and land use structures. The case study region Altmark in Eastern Germany is characterized by long-term population loss, weak economic development, a rather high importance of agricultural land use and no direct connections to major transport infrastructure. In contrast, the case study region Rhine in Western Germany is partly of asemi-urban character, located close to major metropolitan areas, and agriculture plays only a minor role for gross domestic production even though high value added crops such as fruits and vegetables are dominant.

Due to these conditions, distinct demands on land, land use conflicts and current land use strategies can be expected in each case study region. The diversity of the case study regions will thus demand the identification of different climate change-adapted land use strategies in order to develop appropriate and locally acceptable land use strategies. CC-LandStraD will therefore, despite the approach necessarily limited to just a few cases, develop a range of examples for locally adapted land use strategies which can be transferred to a larger number of cases in Germany.

Land use trends in both regions are impacted by a general increase in land prices, an increase in market prices for agricultural products and a high demand for forest products. This leads to an intensified agricultural and forest production and a reduction in extensive land use practices. Environmentalists in both regions therefore claim the loss of endangered habitats. In addition, a regionally specific impact on land use was reported by interviewees. In the Altmark the establishment of decentralized renewable energy plants has reportedly increased the production of biomass, mainly maize, for renewable energy production. Further conflicts are, in context, the extension of the Motorway 14 (sector settlement and transport) and the establishment of new protected areas.

In the focus region Rhine especially the high population density leads to a high demand for settlement and transport areas. This is opposed to agriculture and nature conservation interests (see also Deliverable F 1.2).

2.6 Synthesis

The potential of the interdisciplinary and transdisciplinary approach of CC-LandStraD and composition of project partners was used to synthesize new products, especially in the fields of stakeholder process, scenario development, model integration and assessment of land management strategies and its contributions. Achievements of the synthesis are as follows:

– After a successful motivation of numerous stakeholders to participate in CC-LandStraD, a concerted scenario concept was prepared that was drafted by experts and was annotated, amended and approved by stakeholders. The scenario framework synthesizes different disciplines and interests that additionally combines modeled quantitative global scenarios (GLUES) with regional scenarios. Experience from previous scientific policy counseling projects shows that a consensus on the scenario concept is crucial for the acceptance of results and conclusions by stakeholders.

– A joint working paper was written that comprises detailed information on the status quo and challenges of land use of all major land using sectors in Germany and the interaction between land use, land use change and ecosystems. The paper also contains a first step towards a consistent cross-sectoral projection of the expected land use. At this stage of the project it basically consists of a collection of sector land use projections that will be harmonized in the course of the project. Without the initiative of CC-LandStraD this valuable and innovative product would not be created.

– A wide field for scientific synthesis is the integrated modeling. The already existing interaction between some models, e.g., LUS, RAUMIS, STAR, SWIM and GROWA/WEKU or MONERIS and the experience gained in coupling these models provide a sound basis for integrating further models. The progress achieved so far to link further models to the network in order to represent the interaction between land use, land use change, the eco(geo)sphere and GHG emissions is describe above.

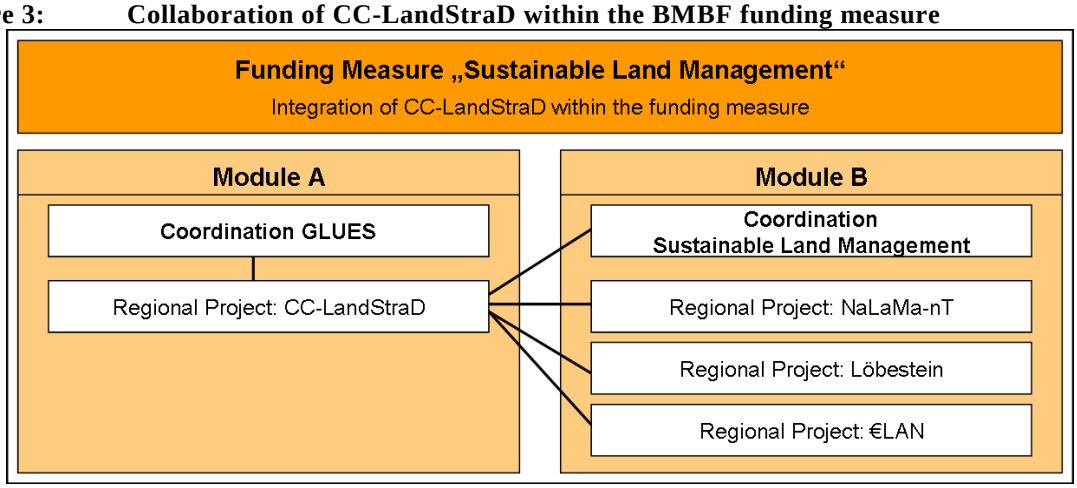
– The result of the work in the starting phase of the project is a coherent framework to accomplish the proposed analyses and achieve the project objective. The framework encompasses the scenario concept, the integrated modeling and the assessment of measures and strategies.

As shown, the productive collaboration has thus far resulted in a good working process and a timely work plan. The precise collaboration is mentioned in the subsequent chapter.

2.7 Collaboration within the BMBF Funding Measure

This chapter presents the characteristics of the collaboration within the BMBF funding measure "Sustainable Land Management." It is structured in two parts: the first part describes the collaboration with the coordination project GLUES in Module A, the second part shows the collaboration with the coordination project Land Management of Module B and three regional projects (NaLaMa-nT, Löbestein, €LAN) in Module B (Figure 3).

Figure 3: Collaboration of CC-LandStraD within the BMBF funding measure



Source: Own illustration.

The **collaboration in Module A** focused on the coordination project GLUES and included the following aspects: information and exchange flow, participation in meetings, workshops and other activities. The information and exchange flow started at the kick-off-event of the funding measure in November 2010 in Bonn, which was attended by members of the following sub-project: Coordination, Regional Stakeholder Process, Land Use Scenarios 2030, Agriculture, Regulatory Systems and Consequences of Land Use and Climate Changes for Water and Matter Balances. Further, in January 2011 an individual meeting took place between GLUES and CC-LandStraD coordinators at the vTI in Braunschweig, where the specific research questions, methodological procedure and project focus were elucidated. In February 2011 a meeting with Moll & Zander on the stakeholder participation in CC-LandStraD took place in Berlin. Besides the coordination of CC-LandStraD, also colleagues of the sub-projects Regional Stakeholder Process, National Stakeholder Process, Socio-economic Assessment, and Regulatory System participated in this meeting. Information and exchange flow also took in a more informal way place at the visited workshops, because these workshops had specific themes. A member of the coordination team and the sub-project Land Use Scenario 2030 attended the Workshops "Models and Scenarios" and "GDI" in May 2011 in Berlin. Furthermore, CC-LandStraD supplied the subpage on the website www.nachhaltiges-landmanagement.de (German/English). The quarterly newsletters of GLUES are shared with the CC-LandStraD consortium. CC-LandStraD informs GLUES via a semi-annual newsletter and minutes

about relevant activities of CC-LandStraD, e.g., the annual project meeting, or invites representatives of GLUES to special events, e.g., the workshops of the national stakeholder process.

CC-LandStraD **collaborates in Module B** with the coordination project of Module B and with three regional projects (NaLaMa-nT, Löbestein, €LAN). The collaboration with the Module coordination includes the following aspects: information and exchange flow, participation in meetings, workshops and other activities through the CC-LandStraD coordination. The information and exchange flow occurs through a semi-annual newsletter and minutes to relevant activities of CC-LandStraD, e.g., the annual project meeting, meetings with regional projects in Module B or the invitation of representatives of the coordination "Sustainable Land Management" to special events such as the kick-off workshop of the national stakeholder process (June 2011, Berlin). Furthermore, the CC-LandStraD coordination participated in the first Fachforum of Module B (March 2011, Berlin), contributed with the oral presentation "Scenarios and Models in CC-LandStraD" and participated in the status meeting of Module B (November 2011, Berlin).

The collaboration with the regional projects NaLaMa-nT and Löbestein focused on research questions. With NaLaMa-nT an intensive exchange regarding the work packages Scenario Development, Model Network and Data Exchange and Assessment has been established. Here the relevant sub-projects of both projects work intensively together. Furthermore, the coordination of CC-LandStraD gave a project presentation at the annual project meetings of NaLaMa-nT (November 2011) and Löbestein (March 2011). Two members of the scientific board of CC-LandStraD are sub-project leaders in Module B projects (NaLaMa-nT, €LAN) and attend the research process in CC-LandStraD. Further details concerning the collaboration are also mentioned in Deliverable C 3.1 and Annex A3. Dr. Jana Hoymann, member of the CC-LandStraD sub-project "Land use Scenario 2030" is member of the scientific board of €LAN and visited the project meetings of €LAN.

As shown there is an intensive collaboration with GLUES as well as with Module B. The link function of CC-LandStraD from the internationally oriented Module A to the regionally oriented Module B was established and will be crucial for future work. This cooperation will further intensify and will be realized, e.g., by data exchange, joint publications, and presentations at project meetings (see A3: list of activities for more details).

3 Status of Research in Sub-projects

In Chapter 3 the sub-projects report the progress on their specific research questions during the first project phase. The chapter is structured according to the work packages in the proposal.

3.1 Work Package: Socio-Economic Framework Conditions – Stakeholder Analysis on National Level

Authors: A. Steinführer, N. Jürges (vTI-LR)

Status of Research – Highlights and Difficulties

In the first project period, the main focus of the work package was on analyzing the socio-economic framework conditions of land use change in Germany. This was accompanied by an extensive stakeholder analysis and the development of a methodology for the stakeholder involvement (see also Chapter 2.1.1 and Deliverables S 1.1, 1.2, 1.3).

The involvement of stakeholders in the project by different modes (workshops, interviews, information provision and feedback collection) can be judged as successful. Almost all contacted stakeholders expressed their interest in the project, its work and results as well as their willingness to take part in the project's activities. The Stakeholder Kick-off Workshop in Berlin in June 2011 was the first highlight. There the project consortium presented the main objectives of its research, the methodological approaches as well as expectations toward stakeholders from agriculture, forestry, settlement, nature conservation and energy production. These issues were critically discussed by the workshop participants and a first feedback was collected from stakeholders with regard to major project topics (land use conflicts, impacts of climate change in the different sectors, mitigation and adaptation strategies). While not all stakeholders could take part in this workshop (some had to cancel their participation at very short notice), the feedback of both participants and non-participants to the project and the opportunities to get involved was very positive. However, the workshop also revealed one of the major difficulties of stakeholder participation: time and budget capacities for continuous participation in a research project are highly limited. This is true for both professional stakeholders (e.g., public authorities or big NGOs with salaried employees) and stakeholders based almost exclusively on voluntary work. Therefore the series of workshops planned in the further course of CC-LandStraD needs to carefully consider these constraints.

Semi-structured interviews are a further mode of stakeholder participation. These will be a continuous activity of the work package until the end of 2012. By the end of January 2012, 17 interviews with national stakeholders (ranging from 30 minutes due to time constraints of the stakeholder to more than 2 hours) were conducted, transcribed and are currently analyzed (by employing the qualitative text analysis software MAXQDA). In this first round of interviews, the focus was on stakeholders from agriculture, forestry, settlement and nature conservation. They reveal that climate change is an issue for most stake-

holders (though to different degrees). The stakeholders also referred to a number of measures and strategies to mitigate climate change and to adapt to its impacts.

The main difficulties in this project phase were again primarily related to limited resources both on the stakeholders' side and within the work package. Most stakeholders face very strong time constraints and often had to cancel appointments or shorten interviews. Preparing and organizing the interviews (let alone their analysis and interpretation) was much more time-consuming than originally foreseen. This necessarily led to a restricted number of realized interviews.

Modification to the Proposal

In contrast with the original intention to conduct standardized surveys with stakeholders, it was decided to apply another method (semi-structured interviews) in this phase of the project. This can be justified with the complexity of the topics raised (land use conflicts, climate change), the high degree of uncertainty with regard to long-term projections of climate change and its impacts as well as the limited scientific knowledge about already applied measures and strategies in the different land use sectors. A standardized questionnaire would require robust pre-knowledge in all of these fields in order to suggest meaningful questions and answer categories. Moreover, during the preparation of the semi-structured guidelines it also became clear that not only each sector (agriculture, forestry, settlement, nature conservation) requires a specialized guideline but that each stakeholder needs to be approached individually. Therefore, using semi-structured interviews – which provide interviewees with the opportunity to highlight priorities and give in-depth explanations and which also allow interviewers to adapt guidelines in the course of the empirical phase – was regarded as the most appropriate tool in this project phase. What is more, semi-structured interviews are easier to realize than, for example, focus groups (which were also suggested in the project proposal), as they do not require the coordination of dates among different stakeholders. This leads to another adaptation in comparison with the proposal. From the work package team it was not considered realistic or desirable to conduct different workshops in this initial project phase. The one and only stakeholder workshop carried out so far (in June 2011) revealed that such an event consumes a great portion of available resources and, even more important, stakeholders have limited capacities to actually participate in such activities, despite a high degree of interest and even willingness.

Critical Self-reflection

In spite of the necessary adaptations, the work package is on a good path. It contributes in a meaningful way to the overall aims of the project and fulfils its role as a facilitator between the specialized work packages and the stakeholders. It could also sharpen its own research questions to be answered in the course of the project. To be successful also in the second phase of the project, resources and capacities of both the stakeholders and the researchers need to be realistically assessed.

3.2 Work Package: Modeling

Six sub-projects contribute to the WP Modeling. The sub-projects with regard to bio-physical modeling report first, followed by the sub-projects with regard to socio-economical modeling.

3.2.1 Area-wide Analysis of Land Use Change in Germany and its Consequences for the Land Water, Carbon and Nitrogen Household

Authors: F. Wechsung, P. Lasch, M. Gutsch, F. Suckow, P. Gottschalk (PIK)

Status of Research – Highlights and Difficulties

The ecohydrological model SWIM and the forest growth model 4C are our essential instruments for the proposed analyses and require an evaluation of their performance and validity. Evaluations of 4C at individual forest stands using level-II data and the preparation of the model application at 4,583 representative sites in Germany are completed. The ongoing evaluation of the hydrological model SWIM focuses on the representation of arable yields and their variability in time and space and has led to significant progress.

So far, for the Elbe-river basin evaluation experiments with the model 4C were carried out with virtual forest stand data of pine, fir, beech and oak and using soil data of the Federal Soil Map of Germany (BÜK 1000) and driven by climate data of the regional weather stations, prepared by PIK. SWIM was applied similarly to calculate respective yields of winter wheat and silage maize. Net primary productivity (NPP) results of simulations ranging from 1977 to 2006 were analyzed. Further, rates of mean yearly soil water leaching were calculated using the STAR 2K scenario for 2010 and 2050. To calculate forest mean NPP dynamics, a mixture of forest stands and corresponding tree species distributions following the National Forest Inventory (NFI) was assumed. To calculate respective spatial values for arable crops SWIM was run in mono-culture mode.

The seasonal course of NPP (Figure 5) shows a reasonable result for forest stands. The yearly value of 7.65 t C ha^{-1} y^{-1} lies in the range of values given by Pretzsch (2010)[8] who reports ranges of all tree species between 4.6 and 9.4 t C ha^{-1} y^{-1}. SWIM very successfully predicted yields of silage maize which are directly dependent on NPP, therefore NPP values (Figure 4) can be regarded as reasonable. Simulated mean yearly soil water leaching rates for 2010 under forest stands show a similar spatial variability as leaching rates under winter wheat and silage maize simulated with SWIM. The regional variability of precipitation and corresponding leaching rates are well represented (Figure 5). Under the 2K scenario (2050) leaching rates under forest stands are reasonably reduced in all regions. Leaching rates are lower in 2010 under arable cropping than under forest which indicates

[8] Pretzsch, H. (2010): Forest Dynamics, Growth and Yield. Berlin, Springer.

a mismatch of compared water flux outputs and the requirement for more intense model comparison and model analyses of both models.

Figure 4: Mean monthly NPP of the Elbe-catchment for 1977-2003 (-2006 for forest, respectively) and associated temporal variability (standard deviation) for two arable crops (SWIM) and for forest (4C), averaged concerning the share of tree species in the region). Numbers in bold denote yearly mean sums of NPP in t C ha^{-1} $year^{-1}$.

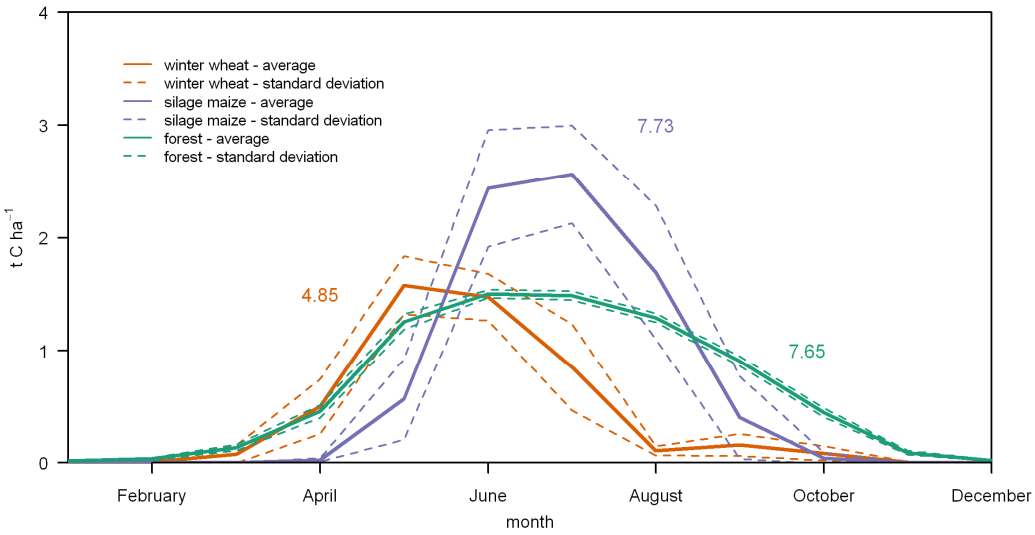
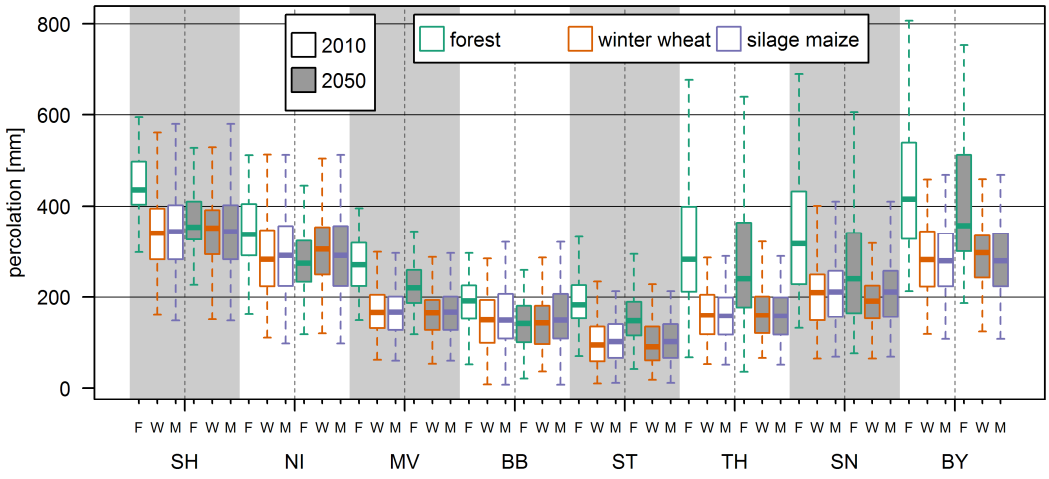


Figure 5: Mean annual soil water leaching below forest stands, winter wheat and silage maize, aggregated for selected Federal states. Box-plots represent median, 25th- and 75th-pecentil as well as the 1.5 fold interquartile range for the sites (forest) and the 100 climate realisations (winter wheat, silage maize).



Modification to the Proposal

There were no modifications in comparison with the proposal

Critical Self-Reflection

The presented results already show progress in fulfilling the proposed and outlined integrated ecohydrological claim. To begin with and due to practical requirements the models are exclusively applied and interlinked in the Elbe river before the simulation framework will be transferred to the whole territory of Germany. Cooperation with other project partners is well in progress.

3.2.2 Agriculture

Authors: M. Henseler, H. Gömann, P. Kreins (vTI-LR)

Status of Research – Highlights and Difficulties

The work of the sub-project "Agriculture" could not start as planned because the process of finding and employing a competent person with sufficient expertise in agricultural economic modeling took until mid 2011. In October 2011, Dr. Martin Henseler joined the team. Due to his profound expertise in regionalized agricultural economic modeling he was able to compensate for the lost time, despite the time generally necessary to familiarize new employees with their the job and with the complex RAUMIS model.

The RAUMIS database was updated in the start-up phase of the sub-project (Deliverable M 4.1). The update extended from the base year 1999(based on the comprehensive agricultural census) to the year 2007 (based on the less comprehensive farm structure survey). The regular update of the RAUMIS model base year is part of the maintenance and was therefore accomplished by vTI staff. In CC-LandStraD some of the proposed analysis depends on the availability of results of the recent agricultural census of 2010. In the 2010 census, e.g., agricultural management practices were surveyed that are important for the modeling of impacts of measures to reduce GHG emissions from agriculture. Because the data was not available until the end of 2011 the main work in the sub-project could not have started anyway. However, the processing and analysis of the partly available regional data of 2010 started immediately. The results were already used in Deliverable S 2.1/S 3.1 to illustrate the political and socio-economic framework conditions as well as the current situation in agriculture.

The preparation of the vTI-baseline in 2011 supported the work of CC-LandStraD. This projection of the agricultural sector in Germany until 2021 was discussed with experts from the Federal Ministry of Food, Agriculture and Consumer Protection (BMELV) and other professionals of the federal states and represents a coordinated reference situation for model based analyses. This work is part of the proposed "Consultations of experts to fine-tune scenarios and management strategies regarding model parameters" (S 1.4) and

will be continued in 2012. The vTI-baseline[9] was analyzed in regard to the data and developments needed in CC-LandStraD. Selected results are presented in the Deliverables S 2.1/S 3.1 and M 4.1. An inventory of available data throughout the model network was taken in cooperation with the sub-projects “Greenhouse Gas Modeling”, “Water and Material Inventories”, “Forest Economic Modeling”, “Settlement and Transportation”. The data were checked in terms of quality and quantity and missing data was identified (see Deliverable C 3.2).

Important information from the sub-project was also shared at the GLUES workshop “Models and Scenarios” and the subsequent discussion process to shape the global scenarios in GLUES. In addition, the sub-project staff cooperated with the Löbestein project (Module B) by preparing data on expected agricultural price developments and made them available to colleagues in Löbestein. The sub-project staff also contributed to the kick-off event of the national stakeholder process in Berlin in June 2011 and contributed to the Deliverables: “Stakeholder tailored discussion paper” (S 1.2).

The work in the first phase on model interfaces between RAUMIS and the models of the sub-projects “Greenhouse Gases Modeling” (i.e., MODE and GasEM), “Water quality” (e.g., MONERIS), “Biodiversity” (e.g., HNV-farmland-indicator), “Socio-economic modeling” (i.e., LUS and forest frame type) and “Water and Material Inventories” (i.e., SWIM) is described in section 2.3. The interface between RAUMIS and the agricultural model CAPRI that is applied in GLUES already exists since both models are part of the vTI modeling network.

Modification to the Proposal

There were no deviations from the project proposal. The temporary delay of the work due to the problems of finding qualified personnel for the tasks could mostly be compensated. In addition, the team was strengthened by the temporary employment of Andrea Wagner from November 1, 2011 to March 31, 2012.

Critical self reflection

The interim delay of the work progress in the sub-project did not affect other sub-projects or the work-flow in CC-LandStraD because all proposed contributions were duly delivered, in particular contributions to the presentation of the existing situation, the scenario development and the socio-economic modeling. Due to the deferral of data availability of the agricultural census to the end of 2011, the update of model data in RAUMIS is not yet complete. In the light of the considerable work progress since October 2011 it is expected

[9] Offermann, F., Gömann, H., Kleinhanß, W., Kreins, P., Ledebur, O. von, Osterburg, B., Pelikan, J., Salamon, P., Sanders, J. (2012): vTI-Baseline 2011 - 2021: Agrarökonomische Projektionen für Deutschland. Braunschweig, Landbauforschung vTI agriculture and forestry research - Sonderheft 355, in Druck

that the proposed objectives of the sub-project will be achieved. Thus, there are no substantial changes in the time planning due to late staffing.

3.2.3 Modeling of Forestry Sector

Authors: N. Ermisch, P. Elsasser (vTI-OEF/1)

Status of Research – Highlights and Difficulties

The creation and utilization of model forest enterprises is central to this sub-project. One of the first necessities for their construction was to choose a suitable research area. The selection criterion for the research area was that it should permit a representative conclusion about the contribution of German forestry to sustainable land management. To facilitate the analyses of forest management and the possible management alternatives of forest owners under changing environmental conditions, information about the natural production conditions and economic key figures of German forest enterprises is needed.

Economic key figures of private communal and state-owned forest enterprises are taken from the German Forestry Accountancy Data Network (TBN) conducted by the Federal Ministry of Food, Agriculture and Consumer Protection. Nationwide information about the natural production conditions can be taken from the National Forest Inventory (NFI). After analysis of these data sets, which are both available at the Institute of Forest Based Sector Economics (vTI-OEF) and against the background of different regional land use options, the entire federal territory of Germany was chosen as the study area (WP M5.1).

The TBN is a nationwide, consistent, annual survey of natural and economic key figures from individual forest enterprises larger than 200 hectares. To create an economically founded operation algorithm for forest model enterprises, the individual key figures of the real forest enterprises of the TBN have been compiled in a data base. The data base permits creating an operation algorithm based on over 700 individual key figures per forest enterprise (WP M5.3).

The NFI is also a nationwide, sample-based large scale forest inventory with continuous sample points. In combination with a geographical information system (ArcGIS), regionally differentiated forest model enterprises with their actual empirical natural production conditions are created, based on a nationwide grid. Currently the statistical suitability of different model enterprises size is being tested. The model forest enterprises are defined with respect to essential sample points, i.e., location, type of ownership, tree species composition and age as well as other forest specific parameters (WP M5.3).

The compiled data base of forest key figures and the modeled forest enterprises are the basis for the further procedure. In the next step explanatory variables are identified through analyses of the TBN enterprise data. After this, multiple regression analyses are conducted and effects on different target variables are quantified (in particular volume of intermediate thinnings, final felling, and subsequent tree species choice). Afterwards the

detected operation algorithm of the real forest enterprises will be applied to these forest model enterprises with their natural production conditions. The aim of this procedure is to analyze the market behavior of German forest enterprises under changing production conditions. Also, regionally differentiated conclusions for possible forestry land use changes and the resulting impacts will be given.

Modification to the Proposal

This subproject started four and a half months later than the overall project, however there is no delay in the work plan. As a minor modification of the proposal, it was decided to use the Strugholtz-Englert model rather than SILVA / BWIN-Pro as a base for the development of forest enterprises, as described and justified above (see Section 2.3).

Critical Self-reflection

The main challenge in the last months was to connect the TBN enterprise data with the data set from the NFI in a way that a conclusion about the different action strategies in German forest enterprises can be drawn, without breaching the privacy of the forest enterprises participating in the TBN. This has been realized in the way described above.

3.2.4 Land Use Scenarios 2030

Authors: J. Hoymann, F. Dosch, G. Beckmann (BBSR)

Status of Research – Highlights and Difficulties

The objective of the sub-project “Land Use Scenarios 2030” is to develop spatially explicit scenario simulations of the future land use patterns in Germany and to analyze the effect of different land management strategies on the spatial development of land use as well as on related CO_2 emissions. The analysis of future trends of settlement and transport areas requires the understanding of past trends of this type of land use that were briefly summarized in Deliverable S 3.1.

Measures in the area of settlement and transport area development to mitigate and adapt to climate change were collected based on an extensive review of literature and research projects (Deliverable S 3.1). They are of special importance due to the long-term nature of that type of land use. Many of these measures have already been discussed with regard to sustainable development. But the analysis also revealed several tradeoffs between mitigation and adaptation measures that are highlighted in Deliverable S 3.1. These tradeoffs will especially be analyzed in the ongoing project. Therefore, the different measures were combined to different scenario strategies (see Section 2.2). The strategies (see Section

2.2) and measures were discussed in interviews with experts from the IÖR[10] and the IREUS[11].

A precondition for the proposed land use change modeling is the availability of georeferenced land use data. Therefore, publicly available land use data sets were comparatively collected and analyzed. Two data sets were identified to be suitable to represent urban areas and other land use sectors in the best way: the DLM-DE 2009 and GMES Urban Atlas data. The results of the analysis will be summarized in Deliverable M 6.1 by April 2012 and will also be published as "BBSR-Analysen KOMPAKT." In addition, further georeferenced data concerning slope, soil quality, distance relations and planning regulations were collected that represent suitability for the land use change model.

Two land use models are applied to generate the land use scenarios 2030: the PANTA RHEI REGIO (PRR) model and the Land Use Scanner (LUS). They have already been introduced in Section 2.3. The section also describes the established linkages between PRR, LUS and the different land use-related models like the agricultural and forest economic models. Both models, LUS and PRR, have already been used in several studies. The configuration of the LUS model for Germany is going to begin in 2012 by implementing the project-specific data sets but also by programming the indicators to assess the effect of the mitigation and adaptation measures considered. A subcontract was concluded to use the PRR model to calculate the expected regional demand for settlement and transport areas by 2030. Preliminary results were shown in Section 2.3.

An intensive literature research was started to obtain an overview of available approaches to estimate the climatic impact of mitigation and adaptation measures on settlement and transport areas. While assessments of mitigation measures focus on the reduction of CO_2 emissions, different approaches are applied for the impact assessment of adaptation measures owing to different objectives such as human health or water resources. A detailed documentation of the developed assessment approach for CC-LandStraD will be another focus in 2012.

Modification to the Proposal

There were no modifications in comparison with the proposal.

Critical Self-Reflection

The work in 2011 (11 months due to the late filling of the position) was characterized by assessing the status quo with respect to data sets, modeling approaches and current developments of the land use sector. This basic work was accompanied by the successful de-

[10] Leibniz Institute of Ecological Urban and Regional Development, Dresden

[11] Institute of Regional Development Planning at University of Stuttgart

velopment of a personal network in the research community, first within the CC-LandStraD project, second with the GLUES project (participation in scenario, modeling and GDI workshop), third with other module B projects such as €Lan (member of the expert advisory board) and EUDYSÉ (interview partner in expert interviews), and fourth with the modeling community of the Land Use Scanner model in the Netherlands. Moreover, the scenario approach was discussed with experts from IÖR and IREUS.

A difficulty that was revealed during the work is that several measures with CO_2 emission reduction potentials, that are associated with urban areas, are not considered within the project because their application does not lead to a change in the settlement structure within an urban area and within the whole German territory. An example for such a measure is the increase of the energy efficiency of buildings due to refurbishment. A rough estimation of the CO_2 emission reduction potential might be possible in the assessment but there will be no explicit modeling of the measure.

3.2.5 Greenhouse Gases

Authors: R. Dechow, S. Gebbert, K. Brautsch (vTI-AK)

Status of Research – Highlights and Difficulties

In accordance with the time schedule of the project proposal the activities within the subproject focused on the development of model approaches to simulate N_2O and CH_4 emissions of mineral soils (WP M 3.1) and “Development of model approaches for GHG emissions of organic soils” (WP M3.2).

WP M 3.1 started with a literature study on data sets of measured N_2O emissions and CH_4, related environmental and management conditions were collected and existing model approaches tested on these data sets. Measurement-model comparisons indicated that approaches using static emission factors were unsuited to match the measured GHG emissions. MODE were trained and validated on the measured data sets of annual emissions. Furthermore methods were developed which allow an assessment of model uncertainty. The statistical approaches show that beyond land use system and land use intensity (N fertilization), seasonal weather conditions and soil properties explain most of the variability of measured N_2O emissions. In contrast, the type of used fertilizers and methods of application could not reduce the unexplained variability of N_2O measurements which partly might be explained by the unrepresentative appearance of these management options in the measurement data set. Disaggregated land use maps, soil maps and data on seasonal weather conditions were used to derive regionalized maps of N_2O emissions and stratified emission factor maps of Germany. Modification factors taken from literature have been implemented to account for the effect of fertilizer types, application methods, nitrification inhibitors and fertilizer additives on direct N_2O emissions.

In accordance to the spatial resolution of the agro-economic model RAUMIS, emission factor maps stratified according to land use system, year (climate warming), and adminis-

trative district will be developed. These maps can be used by RAUMIS to generate land use dependent direct N_2O emissions. Climate change will be considered using climate scenarios of the STAR model provided in Work package M 1. The climate scenario data for positions of German weather stations was temporally aggregated and spatially interpolated to derive raster maps of monthly resolution. Regionalized N_2O emission factors to be implemented in RAUMIS should be finished by March 2012.

Well drained land use systems on mineral soils are small CH_4 sinks (approximately 0.03%–0.04% compared to reported total GHG emissions of Germany). The sink strength of mineral soils is controlled by the soil water budget (gas diffusion) land use system and intensity (fertilization, tillage). To account for these fluxes an approach proposed by Freibauer et al. (2003)[12] is used. The development of improved methods is ongoing.

The work of the WP M 3.2 focused on the development of models to simulate N_2O and CH_4 emissions in response to natural conditions (weather, soil chemical properties) and management (fertilization, groundwater table regulation). A representative data set of GHG measurements was derived by literature research and by contacting national research projects (joint research project “Organic Soils”). It contains about 300 annual values of GHG emissions and related environmental factors on 30 sites. Managed (forest, cropland, grassland) and semi-natural ecosystems (rewetted) are represented.

The methods developed for modeling N_2O emissions on mineral soils (MODE) were trained and validated on the measurements. As expected, most of the variability of measured CH_4 emissions could be explained by the variables groundwater table and temperature during growing period while precipitation, groundwater table and N fertilizer input were the key variables for estimating N_2O emissions. The ground water table is a key variable for all trace gases emitted from organic soils, but up to now no adequate method to upscale annual groundwater tables in response to land use system and natural conditions was found. Methods will be developed in the joint research project “Organic Soils” and will be available within the proposed time schedule of WP M 3.2. Developed models will be transformed into modules that enable models of participating work packages (M2, M4) to simulate GHG emission rates for space time units (year of scenario period and rural district) in response to biomass production (CO_2), land use system (CO_2, CH_4, N_2O) and fertilisation (N_2O).

Modification to the Proposal

There were no modifications in comparison with the proposal.

[12] Freibauer, A. (2003). Regionalised inventory of biogenic greenhouse gas emissions from European agriculture. European Journal of Agronomy Volume 19, Issue 2, May 2003, Pages 135–160.

Critical Self-reflection

The work in this sub-project was to date focused on literature research, selection of representative data sets and model development. The transfer of information and data between modeling groups and a way to link GHG modules to biophysical and agro-economic models could be specified due to collaboration with partners in work packages M2 and M4. Necessary data to generate GHG modules/maps was provided by vTI-LR (land use) and PIK (climate scenarios). The activities within work package M 3.2 benefit from the cooperation with the project "Organic Soils."

There are high uncertainties in the prediction of indirect N_2O emissions mainly caused by runoff and leaching of reactive N from agricultural land use systems. Recent approaches for large-scale estimations of indirect nitrous oxide emissions suffer from simplified descriptions of reactive N losses and highly uncertain emission factors. The uncertainty with respect to reactive N losses of agricultural systems could be lowered by using spatially explicit modeled N losses in the biophysical models.

3.2.6 Biodiversity

Authors: D. Gabriel, S. Klimek (vTI-BD)

Status of Research – Highlights and Difficulties

The work package "Biodiversity" investigates the relationship between land use and landscape parameters and the High Nature Value (HNV) farmland indicator in order to assess potential impacts of alternative land use developments e.g. a substantial increase of biomass production for energy generation on this special indicator. The HNV farmland indicator is based on sample plots which are distributed throughout Germany. To derive the relative importance of land use (e.g., crop diversity) and landscape (e.g., land cover diversity) parameters on HNV farmland, data were gathered on different spatial scales. Based on the results of the analyses, potential trade-offs and synergies between climate change mitigation and the conservation of biodiversity will be discussed in collaboration with the project team and with respect to the German National Strategy on Biological Diversity. The approach and the methods are described in greater detail in Deliverable S 2.1/S 3.1.

In order to carry out the research work planned in the Work package "Biodiversity", Dr. Doreen Gabriel was employed on 01.11.2011. Due to the short contract period ("Biodiversity" is a small sub-project) within the reporting period, this milestone report can only provide a brief overview of work already done in the sub-project. First of all, the data used to compile the HNV farmland indicator was statistically evaluated. Overall, data is available from field surveys of 915 sample areas (each 1 km x 1 km) scattered all over Germany. The total area of HNV farmland comprises 10,017.20 hectares, 68% of which is attributable to land use and habitat types such as grassland, arable and fellow land, and 32% attributable to landscape elements such as hedgerows and field margins. The average

area of HNV farmland across all sample areas is 11.09 ha (minimum: 0.02 ha, maximum: 93.08 ha, standard deviation: 13.01 ha). The work package currently gathers data on land use and land cover, agricultural census statistics aggregated at the municipality level, soil quality, topography, and climate conditions. Based on these data and pre-defined biologically based hypotheses, parameters will be derived that will be used as explanatory variables in the statistical analyses.

Modification to the Proposal

There were no modifications in comparison with the proposal.

Critical Self-reflection

The appointment of a research associate within the work package took place rather late due to the limited availability of the preferred candidate. However, we were able to recruit a highly qualified research associate who has the relevant numerical skills and profound experience in interdisciplinary projects. Presently, the work package is involved with data acquisition and data processing, which is, according to experience, time consuming.

3.3 Work Package: Integrated Assessment of Land Management Strategies

To allow for both a general assessment of different land use forms and a specialized look into agricultural land use and forestry, CC-LandStraD integrates two assessment subprojects. A third sub-project “Environmental and Spatial Planning Law in Land Use” (WWU) looks at the formal and informal regulatory systems in this field.

3.3.1 Integrative Socio-economic Assessment

Authors: S. Rajmis, J. Hirschfeld (IÖW)

Status of Research – Highlights and Difficulties

As outlined in Deliverables A 2.1 and A 2.2, society demands production, regulatory, cultural and supporting ecosystem services from agriculture and forestry, such as the provision of food and water or the experience of biodiversity and other cultural services. The supply and quality of ecosystem services are sensitive to land use types and changes.

To identify the most appropriate land use strategy, policy makers need to be able to compare the effects of different management alternatives. Cost-benefit analysis reduces the complexity of the decision problem by translating multidimensional effects into monetary values. Results of the societal/socio-economic assessment enable policy makers to include the societal value of ecosystem services in their decisions.

In the first phase of the sub-project an integrative framework for the assessment of ecosystem services has been developed which is compatible to the valuation framework of the forest sub-project vTI-OEF/2 (see Section 3.3.2). The submitted deliverables include an overview of the valuation framework (Deliverable S 3.1), an outline of the methodological concepts of the assessment such as avoidance cost (especially relevant for the valuation of regulating services) or stated preference methods (focussing cultural services) (Deliverable A 2.1). Based on the literature research, we discuss problems and limits of the methods. A detailed description of economic valuation studies and monetary values measured so far for ecosystem services and goods relevant to land use issues can be found in Deliverable A 2.2. In Deliverable C 3.1 we discuss the compatibility and complementarity with the other sub-projects (and policy concepts relevant to land use). The literature research has been completed and the frame for the cost-benefit analysis and population survey has been finalized. Based on data input from partners involved in the integrated modeling (see Deliverable A 2.1 and A 2.2) and own investigations, an extended cost-benefit analysis will be conducted. Societal preferences will be assessed by a representative survey within the German population including pre-tests, pilot study and main study.

The joint project and sub-project(s) were presented in September 2011 on a national conference ("Biodiversity and climate") organized by the German Agency for Nature Conservation (BfN) (see Annex A3). Further the IÖW established close cooperation with vTI-OEF within the joint project (see Section 2.4).

Modification to the Proposal

The project team (lead by Dr. Hirschfeld) was completed only four months after the start of the project (Dr. Rajmis started her work at IÖW March 1, 2011). The time schedule has been adjusted accordingly to reach the aims of the proposal within the time frame of the project as planned. There were no modifications in comparison with the proposal.

Critical self reflection

Cooperation with other partners within the project as well as external cooperation with other research institutions has been set up and a promising basis for the planned survey has been elaborated, as explained above.

3.3.2 Forestry: Analyses of the Nonmarket Value of Ecosystem Services

Authors: P. Weller, P. Elsasser (vTI-OEF/2)

Status of Research – Highlights and Difficulties

As outlined in Section 2.4, society demands various ecosystem goods and services from forests, some of these are public goods. Policies targeting climate change may affect ecosystem goods and services. Therefore, usable monetary values are required to enable pol-

icy makers to integrate these public goods and services into their policies. In CC-LandStraD the valuation of ecosystem services is specifically focused on politically relevant topics like nature protection and landscape conservation.

The analysis of the available forestry-related literature scheduled for the starting phase, has been launched; preparations have started for the benefit transfer study to be conducted in year 2 (Deliverable A 2.3) and staff is becoming acquainted with the relevant statistical methods. The establishment of a workgroup with IÖW and TU Berlin will promote the earliest possible realisation of the planned national survey. Furthermore vTI-OEF is a member of the EFI-Nord research network[13], which also deals with recreation in forests.

The analysis of the available literature from the past two decades regarding the valuation of public goods has proven that European countries are covered, but the regional focus lies on Scandinavia and the UK. Studies for Germany are rare and they usually only cover case studies, e.g., a specific national park. Most of the available research so far concentrates on recreation or biodiversity. Yet there is little evidence about the interdependencies between changing land management and nature protection or recreation, or about marginal changes of their provision. These aspects are targeted by CC-LandStraD.

Economic valuation will be done by conducting a choice experiment (CE), which is accepted as a standard valuation technique. The operationalization of landscape determinants for the CE is done by choosing several attributes which describe the good to be valued. The workgroup has elaborated a respective list of attributes and is now preparing the population survey and the CE, so that pretests will be conducted in spring 2012.

To strengthen necessary in-depth knowledge of relevant statistics, the junior researcher attended a two week-workshop, dealing with the design and modeling of CE, held by leading researchers in the field of CE. Current problems relevant for environmental valuation were also discussed.

Furthermore, in November 2011 vTI-OEF/2 has conducted a population survey, which elicits willingness to pay values regarding the relationship between forest management and recreation. This survey was financed independently from CC-LandStraD, however the results can be seen as fundamental research contributing towards the survey planned. The combination of the results of vTI-OEF/2 and vTI-OEF/1 (Section 3.2.3) will provide a comprehensive analysis of the forest sector.

Modification to the Proposal

After joining the team five months after the official start of the project (in April 2011), the junior researcher quickly became acquainted with the topics. There were no modifica-

[13] EFI-Nord research network: North European Regional Office of the European Forest Institute

tions in comparison with the proposal.

Critical Self-reflection

The research team is now pursuing an ambitious time schedule, as work on the population survey was picked up well ahead of the plan.

3.3.3 Environmental and Spatial Planning Law in Land Use

Authors: M. Gottwald, U. Grabski-Kieron (WWU)

The two-tier approach at this phase of the WWU sub-project consists of the analysis and evaluation of the existing German statutory and non-statutory system of planning and incentive instruments in the spheres of spatial planning, agrarian structure planning, environmental planning and nature protection. The analyses and evaluation are considered in terms of their ability and potential to implement new forms of a climate change-optimized and sustainable land management. Secondly, the WWU discusses these regulatory system issues in the national and regional stakeholder processes (see Sections 3.1 and 3.4).

Status of Research – Highlights and Difficulties

In accordance with the diverse focal points of the CC-LandStraD sub-projects and the parameters eligible to optimize land use addressed there, the relevant formal legal regulatory systems and incentive instruments on EU, national, and federal states have been encompassed in a total of 10 fields of the above mentioned legal spheres. Also currently discussed informal instruments, concepts, and approaches and their potential to influence a climate-optimized land management are collected and prepared.

The analysis of the statutory systems was led by the following aspects: 1. influence on actual land use; 2. importance of existing tools in regard to climate change; 3. connection to demands of climate adaptation and mitigation. The systematic survey of law matters allows gives an overview about status quo of the land use-related legal instruments in Germany. A detailed matching with parameters relevant to other sub-projects was started at the end of 2011: All project partners were asked to give a concise feedback relating to their special fields. Thus the completed analysis will provide insight into conflicts within the existing regulatory systems, e.g., incentive and subsidy instruments on the one hand, and requirements of the scenarios in progress, on the other hand. Furthermore, the way will be paved to identify approaches for the improvement of the law areas considered.

Still with regard to the same issues, the WWU is involved in stakeholder processes. In general, regional stakeholders favor a subsidiary decision-making in regard to land use issues in their region. Thus it appears reasonable to constrain external regulations from upper levels. Actual regulative instruments usually do not exactly reflect this request. But they are considered partly suitable: actual regulatory tools feature a satisfactory set of problem-solving capacities according to land use and climate change. Mostly, however, only few basic approaches exist towards impacts of climate change – locally it is per-

ceived as a rather abstract threat. The lack of precise ideas of the upcoming impacts may explain the often voiced request for better regional climate modeling.

Some stakeholders do see a good opportunity to establish informal planning initiatives which might help to increase awareness and solve land use conflicts on the basis of consensus. Compulsory planning proceedings can later build on such regional processes.

Modification to the Proposal

In the context of the stakeholder process in the focus regions, the WWU intended to join interviews with selected stakeholders in project year 1 in order to address issues of regional governance, especially the handling of legal instruments within regional initiatives. The sub-project decided to conduct interviews with relevant stakeholders on the Länder level of the focus regions (in North Rhine-Westphalia also referring to district government as part of the state administration). In the state of Saxony-Anhalt the Länder level is of special interest because regional districts do not exist within the administrational structure. In North Rhine-Westphalia, with its system of central cities and dense settlement patterns, the survey on upper decision-making levels may help to address urban-rural relations issues, e.g., in the Cologne-Bonn region where the focus region is situated.

Critical Self-reflection

The realized analysis very soon proved to be the essential base to meet the demands of transferability of research findings into practice planning and implementation of measures. Two aspects turned out to be smaller obstacles on the way to precisely carry out the programmed steps of research: due to the complexity of the German statutory instruments of spatial and environmental planning, and in regard of the meanwhile extended status of bibliographical references dealing with the future demands on the legislation, the initiated literature review required more time than scheduled.

In contrast to the statutory instruments, the non-statutory, so called ‘informal,’ instruments had to be detected in a more ‘diffuse’ way: Their incentives and impulses on land use systems are very much dependent on the respective regional conditions. This gave additional strength to the role of the stakeholder analysis, fostering contributive participation in the concerned sub-projects. The important role of practical experiences as shown by the stakeholder analysis on regional and national level was very soon evident. They gave reason to smaller modifications in the working process determined to provide essential input of the regulatory system analysis to the stakeholder research, on the one hand, and to gain appropriate feedback of the stakeholders themselves, on the other.

3.4 Work package: Stakeholder Process in Focus Regions

Authors: W. Crewett, R. Siebert (ZALF)

Status of Research – Highlights and Difficulties

Deliverables F 1.1 and F 1.2 were finalized in accordance with the work program of subproject "Focus Regions." Based on an analysis of statistical material and a review of the relevant literature, the socio-economic structure in the case study regions Altmark and Rhine was described and relevant stakeholders were identified.

With respect to the upcoming research work, an intensive stakeholder dialogue was initiated in both case study regions. Therefore, contacts to relevant key actors and land use relevant organizations were established and supporting local partners were identified. For the Altmark region, a partnership with Regionalverein Altmark e.V. was set up. During a board meeting on May 30, 2011, the objectives of the project were intensively and constructively discussed with its members. Correspondingly, on July 18, 2011, the project's objectives were outlined, the selection of the case study region "Rhine" was constructively discussed, and first contact persons were identified during a meeting at the Ministry for Climate Protection, Environment, Agriculture, Nature Conservation and Consumer Protection of the German State of North Rhine-Westphalia in Düsseldorf.

This was followed by the identification of further stakeholders. Identification and selection of regional Stakeholders are described in detail in Deliverable F 1.2). By means of expert interviews, land use and land use change as well as climate change related knowledge and perceptions of regional stakeholders were identified. Therefore, 46 stakeholders (experts from the relevant land user groups in the fields of agriculture and forestry, settlement and transport and natural protection) as representatives of 40 stakeholder groups were interviewed by means of a semi-structured questionnaire (see Deliverable F 1.1) between June and November 2011. The interviews were transcribed and analyzed with qualitative text analysis software (MAXQDA). The results of the socio-economic structure analysis and the findings of the empirical survey are documented in Deliverable F 1.2.

The preparatory work for the start of the next project phase has been finalized. In the following phase, starting in 2012, sector specific focus groups will be conducted first. The different sector-specific land use preferences of the regional stakeholder groups and their perceptions of land use strategies for climate change mitigation and adaptation will be identified and discussed. This will be followed by a series of feedback loops during which a common discourse of scientists and stakeholders on common, practically relevant, climate change mitigation and adaptation land use strategies will be developed.

Modification to the Proposal

There were no modifications in comparison with the proposal.

Critical Self-reflection

The stakeholder process in the focus regions started positively. A large number of stakeholders agreed to cooperate during the course of the research work. It is very positive that in the focus region Altmark the integration of the Regionalverein Altmark e.V. was achieved in cooperation with the project coordination. In the focus region Rhine no similar organization working in both administrative districts exists. However, it was instead possible to achieve the support of cooperative and locally rooted contact partners in the district administrations. These contacts will be helpful for further linkages to the research in the focus regions. Very positive was the cooperation with colleagues from the WWU who possess specific background knowledge on the focus region and who served as “door-openers” for the work in the focus region.

In order to ensure and to further intensify the regional/local stakeholder participation over the course of the project duration, it will be important to dedicate best efforts in order to integrate stakeholder interests and to develop an intensive dialogue between scientists and stakeholders in the focus regions. This is not a single “act” but has to be a continuous process. It will be crucial for us to focus on some of the regional problems surveyed in during the expert interviews and derive regionally/locally relevant (interim-) results.

3.5 Coordination

Authors: J. Fick, H. Gömann (vTI-LR)

Status of Research – Highlights and Difficulties

The highlights of the project coordination during the last 15 months can be divided in two parts: internal communication in CC-LandStraD and the research measure, and external communication and dissemination. The kick-off-event in January 2011 and the "Scenario-Workshop" in April 2011 in Brunswick, as well as the first annual meeting in November 2011 in Bonn can be highlighted. The project coordination supported the kick-off meeting for the sub-project "National Stakeholder Process" in June 2011 in Berlin and attended and contributed to several workshops by GLUES and the Module B. For detailed information please see Chapter 2.7 and list of activities (Annex A8).

Considerable effort of the coordination was devoted to the compilation of the Reports S 2.1 and S 3.1, as a major task for most sub-projects. Both reports represent the status quo of the relevant research fields of CC-LandStraD and set a clear basis for all sub-projects for the upcoming working phase. Besides the compilation of overall project activities and reports, the coordination also ensures that the planning milestones are achieved (see Annex A1).

Secondly, for external communication and dissemination a project leaflet was developed, a project homepage was created (www.cc-landstrad.de) and public relations activities carried out, including e. g., a semi-annual newsletter, press releases, a podcast and articles in regional newspapers (concerning the focus regions).

Besides the external communication channels, the CC-LandStraD consortium assigned a scientific board to disseminate information on the research approach and later on the research results to the research community. The members of the scientific board belong to the five major disciplines of CC-LandStraD: agriculture, forestry, settlement and transport, climate and sustainability (see Section 2.7 and Annex3). Two members attended the first annual meeting in November 2011 in Bonn and gave valuable comments. Other members are already actively involved in activities of specific sub-projects.

To communicate CC-LandStraD in a broader way, it was registered in the database of the German Academy for Spatial Research and Planning (www.klima-und-raum.org) and on the website of the German Federal Ministry of Food, Agriculture and Consumer Protection (http://www.klimawandel-und-klimaschutz.de/service/links/). A detailed overview of all external communication and public relation activities of CC-LandStraD is to be found in Deliverables C 5.1 and C 5.2. All public relation activities are compiled there.

Budget

Due to unforeseeable circumstances some partners had to shift budget from the reporting period (till April 30, 2012) to the remaining period till 2015. This was due to several reasons:

– Difficulties in recruiting qualified staff (e.g., BBSR, vTI)
– Shift of stakeholder activities to the end of 2012 (e.g., sectoral focus groups)
– Shift of sub-contracts after the go- no go deadline (April 30, 2012)

As a consequence, planned resources in 2011 are shifted to 2012 and 2013. These shifts will affect only the yearly planned budget (as mentioned in the proposal), not the cash provision as mentioned in the notification letter (see financial overview in Annex A6).

Modification to the Proposal

There were no modifications in comparison with the proposal.

Critical Self-reflection

Despite late contracting of qualified staff members, no substantial changes had to be made to the project proposal. Furthermore, the team building worked out very well and a good teamwork atmosphere could be created in CC-LandStraD. However, the interdisciplinary and transdisciplinary research requires time for discussion, reflection and adjustment. Especially the collaboration with stakeholders requires carefully coordinated action by all involved project members. The coordination of CC-LandStraD established strong links with GLUES and Module B (see Section 2.7, Annex A3).