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New responsibilities of agriculture: structural differences in stakeholder networks and intentions towards climate change abatement strategies in peatland

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Abstract

Agriculture is required to fulfil the needs and wants of society in a variety of fields: food supply, environmental services, landscape preservation and finally: climate mitigation.

Using the example of land-use change in peatland in order to create possibilities for greenhouse-gas reduction, a survey about the intentions and future expectations of stakeholders was undertaken. The underlying network structure of these stakeholders in three representative peatland areas of Germany was determined and compared.

The results show that considerable differences exist in the degree of knowledge about climate change and in the willingness to cooperate. Depending on the area studied, the most influential political entities are different and thus require different strategies for agenda setting. From the study it can be concluded, that the realisation of a political or societal goal, for example greenhouse-gas reduction, relies largely on the intentions among the stakeholders and structural differences in the stakeholder networks. Our example has shown that for these reasons, land-use change for climate protective reasons will be supported more in the study-area in the South of Germany in comparison to the case in the eastern part.

Keywords:

Land-use in peatland areas; network analysis; climate change mitigation.

JEL classifications:

D83, D85, L31, Q54.

1. Introduction

The international community has come to the consensus that society must reduce anthropogenic GHG emissions in order to combat climate-change.

Peatland areas throughout the world are seen as crucial for future climate-change abatement. The type of land-use seems significant, because these lands may or may not function as net-emitters of greenhouse-gases. Recent studies on gas exchange of climate-relevant trace gases from rain fed- and high-rise bogs in Germany show that the intensity of land-use affects the CO_2 storage capacity. It is estimated that currently 2.3 to 4.4 % of Germany's total anthropogenic GHG emissions originate from peat-lands and cultivated marshes (Drösler, 2008). These are called the fens and are the areas with the largest fluctuations. In particular, the groundwater level is relevant for a build up or decomposition of peat, which is crucial for carbon storage. Also, the formation of nitrous oxide (N_2O) is influenced by the soil management and the intensity of fertilizer-use. If a waterlogged situation is created, there will be large amounts of methane produced (*ibid.*). This is especially problematic for the climate balance, since methane has a 23-fold global warming potential in comparison to carbon dioxide.

Climate-change potentials of peatland are expected to be included on the political agenda due to recent scientific knowledge on the land-atmosphere interaction in European peatland. However, any change in current land-use practices towards a higher abatement function of such lands go hand-in-hand with socio-economic effects for the stakeholders in the area (in particular, income losses). For the study, this called for a pre-assessment of the possibilities to develop policy strategies that take the economics of these peatlands into account. It is assumed that whether or not changes to the current situation are accepted, is largely based on the knowledge of the stakeholders and their willingness to co-operate.

2. Objective and method

The investigation covers three peatland areas in the North, East and South of Germany. For the study, the structural investigation method of network analysis (Wasserman and Faust, 1999) is combined with a qualitative survey in order to identify the views, interests and goals of the stakeholders as well as future expectations with regard to climate change and land-use practices.

The objective is first, to identify all stakeholders involved in land-use and to structure them according to their political or social entity. Based on the theory of egocentric networks (Jansen, 2003), wherein the *ego* is part of a network-like structure, lists of stakeholders are generated in each of the study areas and these stakeholders receive the questionnaire. Even though individuals are surveyed, most of the interviewees are representatives of organisations, companies or institutions in general.

Secondly, a set of metadata on the stakeholders' views, risk perceptions, autonomies of decision and past activities is collected in each area. The questionnaire explores the information status, different development goals, protection interests and activities.

The third objective is to determine the structural relationships between the stakeholders, including the strength of interconnections between the stakeholders and identify the most central stakeholder through network parameters in each study area. The collected data is evaluated using the computer program *VISONE*, Version 2.4.1 (Brandes and Wagner, 2004; Brandes and Wagner, 2004). Several network-specific indices are calculated and compared on the level of the individual and across the three study regions. The software enables the generation of sociograms. These are used to display and investigate structural features on the level of the entire network.

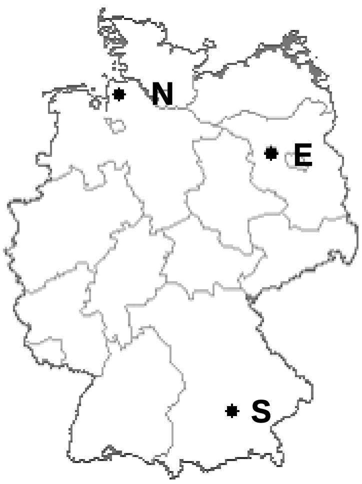
Finally, the structures of the networks in relation to the metadata of the individual stakeholders are analysed and cross-compared. Of special interest are possible significant differences between the areas and when present how these differences can be tracked back to general drivers or pressures in these areas. The underlying goal is to find differences between the regions, which stakeholders or political entities are especially responsive to climate protective measures related to land-use issues. As well as which parties might be more difficult to convince or even are likely to become opponents of these measures.

Most of the polls were distributed partly in electronic form, partly printed and mailed between 08/2007 and 01/2008. In some cases questionnaires were delivered personally. In the North, 32 questionnaires were sent out and 29 returned (response rate: > 90 %), in the East, 30 were sent out and 24 returned (response rate: 80 %): In the South, 34 questionnaires were sent out and 29 were returned (response: > 85 %)

After the characterisation of the study areas, results are presented in two parts. Chapter 3 will show the results of the stakeholder opinion on land-use, nature- and climate protection and Chapter 4 will introduce the method and present selected results of the network analysis.

2.1. Characteristics of the study regions

To have a balanced and representative overview of study areas from different regions – in the North, in the East and in the South of Germany – the following study areas were selected and compared (see Figure 1).



Study Areas in Germany

N – Northern study area *"Ahlenmoor"*

Peatland type: bog
Predominant land-use: grassland

E – Eastern study area *"Rhin-Havel-Luch"*

Peatland type: fen
Predominant land-use: grassland & arable land

S – Southern study area *"Freisinger Moos"*

Peatland type: fen
Predominant land-use: grassland & arable land

Figure 1: Location of study areas in Germany.

North: "Ahlenmoor"

The *"Ahlenmoor"* is the largest bog in the *District of Cuxhaven* federal state of *Lower Saxony*. It covers an area of 4,000 hectares in the centre of the Elbe-Weser river triangle. Geographically the bog is located in the 1,677 km² large landscape-unit of the "North German lowlands, coasts and seas".

The intensive use of the *"Ahlenmoor"* began with the industrial turf cutting in 1957. In the 60s there was intense aerial drainage near the municipality of *Flögeln*. Currently, the *"Ahlenmoor"* serves mainly as pasture, with a proportion of 80 % of the land. Arable land-use is limited to a few spots. About 17 % is uncultivated, with a mere 1 – 2 % left in a natural state. The size of conservation areas in the *"Ahlenmoor"* is currently around 1,300 hectares.

East: "Rhin-Havel-Luch"

In the eastern study area, the network analysis is conducted in the *"Rhin-Havel-Luch"*. The study area is very large and covers 30,000 hectares and is part of the largest complex of lowland in the state of *Brandenburg*. With its ditches, embankments, hedges, alleys and typical urban fragments the area represents a rich cultural landscape. The peatland is shallow and consists of heavily drained fen peat soils. Advanced mineralization and poor conditions regarding possible groundwater restoration resulted from the intense agricultural use that continues partially today.

The peatland complex of the *"Rhin-Havel-Luch"* was until the German Reunification almost completely intensively used by agriculture. Since the beginning of the 60s and 70s the intensification of agricultural use was promoted. For the amelioration of nearly the entire *"Rhin-Havel-Luch"* a drainage network was installed. The intensive management associated with lowering of the groundwater level ensured accessibility by machinery for the cultivation of fast growing grass varieties (Schwärzel, 2000). The use of powerful, but heavier tractors, as well as harvesting and transport technology resulted in high surface pressure with negative effects on the soil (Lorenz et al. 1992, Sauerbrey et al. 1991, and Schultz 1995 in Schwärzel, 2000). Some changes in soil structures are now partly irreversible through setting, shrinkage, mineralization and formation of duff. As a result, the management of those areas is more difficult. Today, agricultural land-use takes place primarily as pasture with extensive temporary cultivation of forage – especially corn for silage. The primary land-use type in the fen and on marsh soils is grassland.

Some areas are nature conservation sites, which are characterized by oak-hornbeam-forests; humid plots with tall herbs and inland dune complexes that harbour numerous rare species of flora and fauna. Particular importance is given to the area due to the thousands of cranes that stop at the site every year in spring and autumn.

South: "Freisinger Moos"

The southern study area *"Freisinger Moos"* is located in the so-called *"Munich gravel plane"* in the federal state of *Bavaria*. It consists of ice-age gravel terraces, deposited by the river Isar and covers an area of approximately 3,000 hectares. As one of the largest and still largely preserved peat-lands in *Bavaria,* it forms a natural link between two other peatland areas close by. The peat layer on the northern edge of the *"Freisinger Moos"* is up to 4 m thick. Towards the south and east thickness of the peat-body decreases (Drösler, 2008).

Since the first half of the 19th Century the groundwater has been regulated in order to allow farming (Kohler, Würzbach et al., 1997). In recent years, this happened in connection with infrastructure works associated with the nearby Munich Airport. A network of trenches drains the area, which are regularly mowed and cleared out.

A high proportion of grassland and a small proportion of scrubland characterize the cultural landscape of the *"Freisinger Moos"*. Until the 60s, the land had been cultivated with low intensity. Since the 90s, the use of arable land became more relevant and resulted in eutrophication of groundwater and surface water. Especially in recent years, the cultivation of renewable energy plants has put a new dynamic to the area, a trend seen nation wide in Germany. Many areas in *"Freisinger Moos"* are regarded as worthy of protection, partly because some species of endangered animals and plants are located there. These include rare species of orchids as the Marsh Helleborine. Nesting sites of the Kingfisher and the Eurasian Curlew – a protected meadow bird – can be found. Among the highly valued nature conservation areas the species-rich meadows and scattered former peat cutting sites are of particular value. Parts of *"Freisinger Moos"* serve as an ecological compensation area for the suburban district of Freising. There were and still are active nature conservation measures undertaken.

3. Results of the regional comparison of stakeholder opinion on land-use, nature- and climate- protection

3.1. Professional and political influence

The respondents were asked to classify whether they perceive a certain professional and/or political influence (see Figure 2).

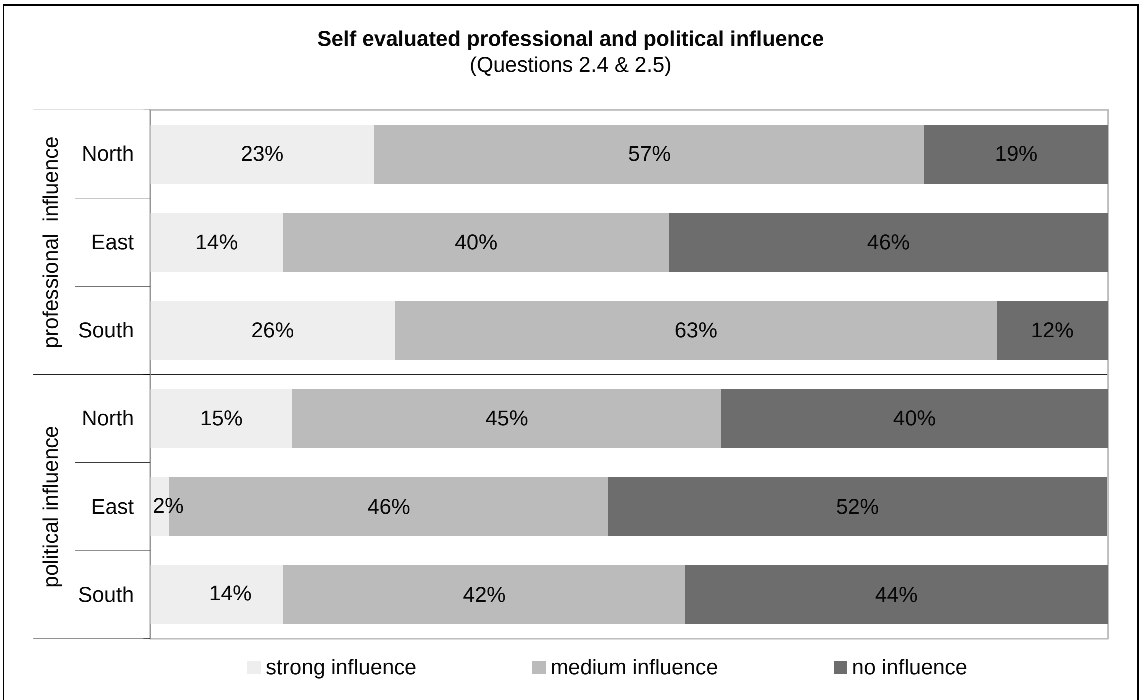


Figure 2: Professional and political influence.

The evaluation gives evidence that the majority in the northern and southern study area perceives a medium influence (57 % and 63 % resp.). In the *"Freisinger Moos"* in the South the shares are more skewed towards a stronger influence as compared to the *"Ahlenmoor"* in the North. In the eastern study area almost half of the respondents state that they have no influence, almost three times as many as in the *"Freisinger Moos"*. A strong influence is only stated by 14 % of the stakeholders, this is also almost half as many as compared to the *"Freisinger Moos"* (see Figure 2, upper half).

Again, the evaluation of political stewardship in the sense of perceived influence shows similarities for the southern and northern study area. About 15 % seem to have a strong influence and the others equally either seem to have medium political influence or no political influence. In the East only 2 % of the stakeholders feel that they have a strong influence and more than half (52 %) state to have no influence (see. Figure 2, lower half).

3.2. Information status and stakeholders' role as opinion leaders

The information situation about the planning processes and the political intentions in the respective region is evaluated to determine the sender-receiver position along the flow of information. Therefore the strength of information reception and the strength of information propagation are determined.

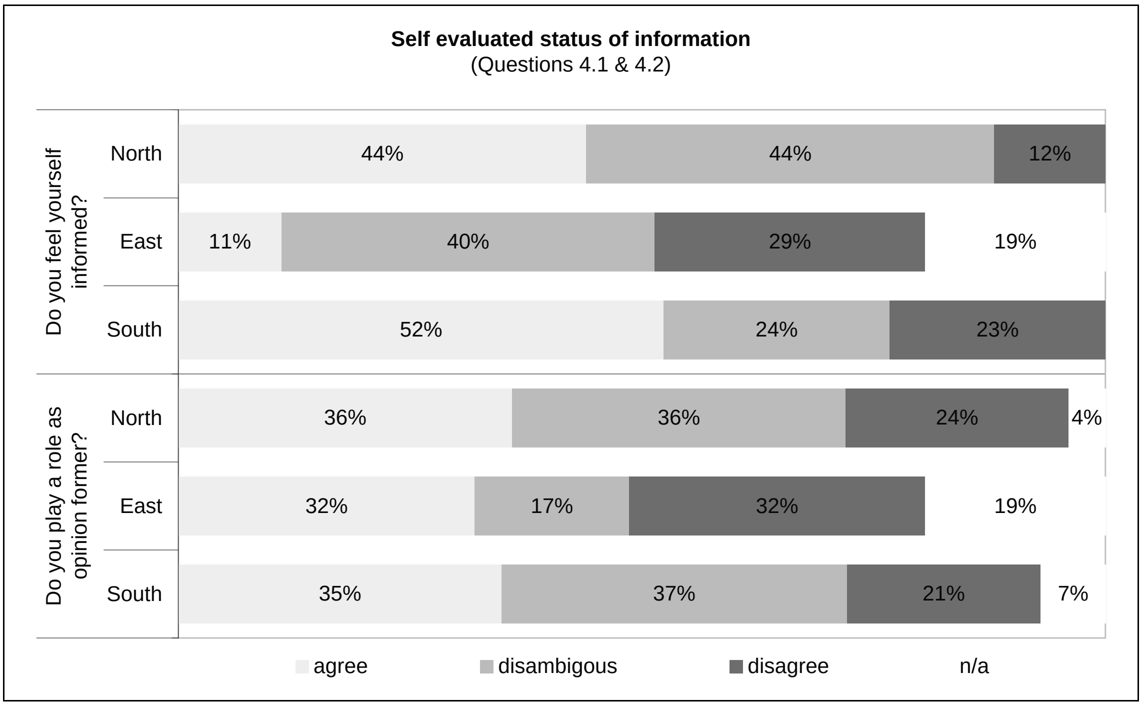


Figure 3: Information status and role as opinion former.

The information situation with respect to the perceived level of information shows the highest satisfaction in the southern study area *"Freisinger Moos"* (52 % agreed) closely followed by the northern area *"Ahlenmoor"* where 44 % agree on sufficient information provision. On the contrary, stakeholders in the East responded to only 11 %, that they feel informed about the current situation and planning processes in their area. Here the majority (40 %) of stakeholders feel informed to at least some extent. A distinct lack of information about the ongoing planning processes became evident. A high fraction in the East does not feel sufficiently informed (29 %) accompanied by a high fraction (19 %) that rejected the question (see Figure 3, upper half).

Additionally stakeholders were able to express their perceived ability to disseminate knowledge and information and take an active role in information exchange and therefore influence over what the public thinks about certain issues.

The results for the North and the South show a very similar picture in all possible choices. In all three study areas, about one third agrees to hold positions as opinion leaders. Clear differences between the study areas show up among the stakeholders lesser-involved. In the South, the fraction that does not play an active role is the lowest (21 %), similar to the northern study area (24 %). Among stakeholders in the East a bimodal distribution became visible. Almost one third does not take an active role as opinion leader (32 %). Also, people in the East are more decisive, whether they do or do not take an active role as opinion former (insider/outsider). What is also outstanding, in the East, 19 % of stakeholders did not make a choice, compared to 4 % in the North and 7 % in the South.

3.3. Relevance of peatland protection – status quo and future

Of explicit interest is the current relevance of peatland protection to the stakeholders in the respective areas. Furthermore the expected relevance in the future was determined by asking whether or not protection becomes more relevant or if it remains the same in the future.

The lowest relevance is currently expressed from the stakeholders in the East *"Rhin-Havel-Luch"*. Here 58 % consider the relevance as high, albeit 8 % consider it small and 17 % give protection no consideration at all. Contrary to that, in the South 66 % of stakeholders consider peatland protection a high relevance and only 10 % consider it to be small. No one believes that peatland protection has no relevance at all. The results for the North take a middle position (see Figure 4).

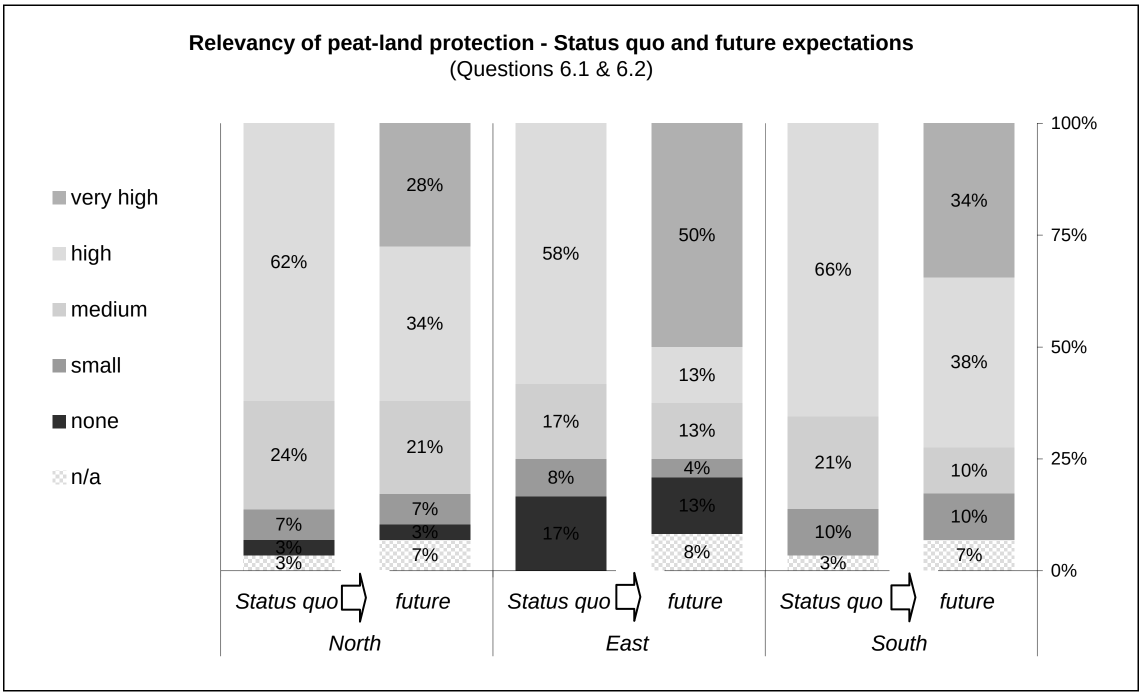


Figure 4: Relevance of peatland protection now and in the future.

The fraction that did not make a comment about the relevance of protection was much higher in all regions when asked about the future expectation. Strong increases were visible both in the *"Freisinger Moos"* and in the *"Rhin-Havel-Luch"*. In the eastern study area, 50 % consider the protection to be of a very high relevance in the future, whereas only 58 % considers it to be high at present. Here a strong paradigm shift becomes evident. Possibly because stakeholders in the East see their peatland under more of a threat than in the other two sites. Still, a constant 13 % consider peatland protection not relevant in the future.

3.4. Significance of peatland protection

Out of six categories the significance of peatland protection could be defined and ranked according to their priority.

In the northern study area *"Ahlenmoor"* all protection categories are present in the highest priority level. Nature Protection (34 %), followed by protection of soil & peat (22 %) and maintenance of recreational value (16 %) are the most prominent. In the East *"Rhin-Havel-Luch"* only three categories – nature protection (42 %), protection of soil & peat (33 %) and climate protection (25 %) – are considered as a first priority. The *"Freisinger Moos"* shows a clear dominance in the categories of soil & peat protection (42 %) and nature protection (40 %), (see Figure 5).

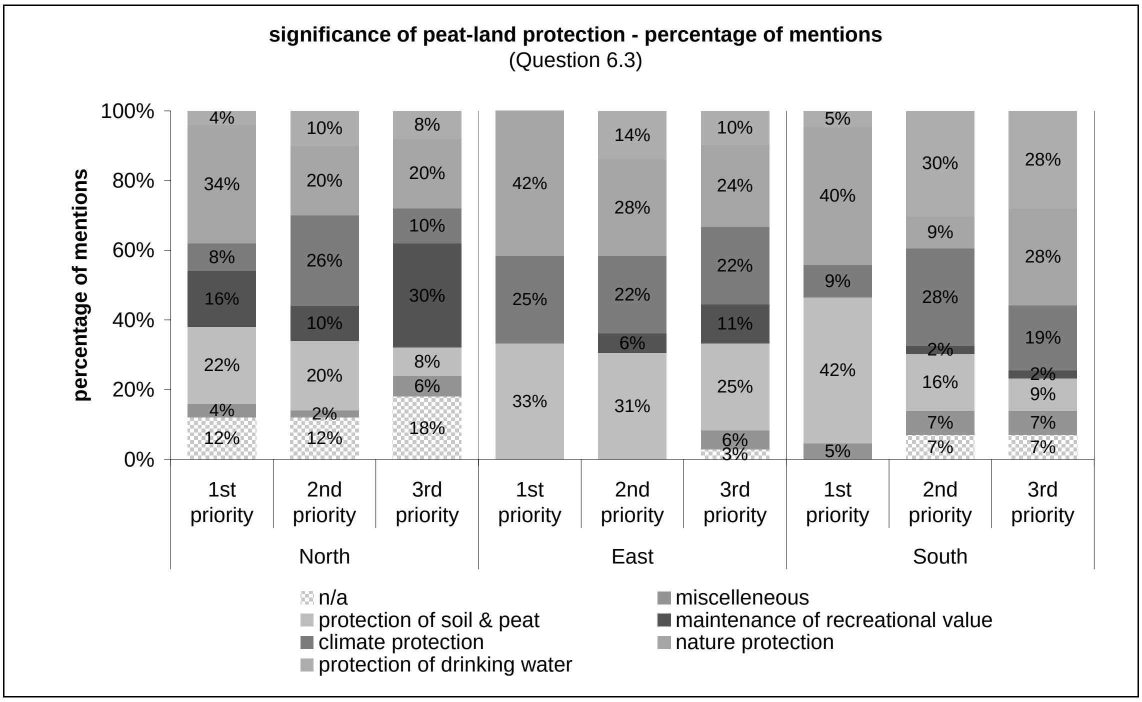


Figure 5: Significance of peatland protection according to its priority.

Climate protection becomes the most important issue in the 2nd priority class in the North. In the East the protection of drinking water is first mentioned and does not play a role at the 1st priority rank. In the South the protection of drinking water becomes the most important issue.

The maintenance of recreational value seems to play a minor role in the *"Freisinger Moos"* whereas in the North, it is the most important issue and is present at all three priority levels.

4. Network analysis

4.1. Methodology

Network analysis permits the visual and mathematical analysis of human relationships. This method is now considered "one of the most promising directions of research in sociology" (after Emirbayer & Goodwin 1994 in Jansen, 2003). Also known as *Social Network Analysis* [SNA], the main area of its utilization is primarily in North America. Also the central organisation of the network analysis, the *International Network for Social Network Analysis* [INSNA] is located there (INSNA Webpage, 2007). In Europe, network analysis is only established to a small extent (Jansen, 2003). For the U.S. however, a 45-year-old history of application of network analysis is reported (Laumann, 2006). Currently network analysis is gaining greater importance in various scientific fields.

On the website of the *Applied Graph & Network Analysis* project, network analysis is defined as a collection of mathematical-technical methods of social-psychology, sociology, ethology and anthropology (Benta, 2003). Thereby, a group communicating with each other is established as a group of nodes, each node representing a member of the group. Additionally there are a number of edges, each standing for a process of communication between the players (Benta, 2003).

It is assumed that the shape of the communication processes among the group members influence their performance, leadership qualities and satisfaction (Benta, 2003). KREBS (2007) defines the SNA as a recording and measuring of relationships and flows between people, groups, organizations, animals, computers or other information/knowledge possession units. Data on the relations between actors are according to JANSEN (2003) collected in the following fields:

- Exchange of information (Who is influenced by whom? Who provides information to whom?);
- Resource exchange (money, personnel …);
- Memberships (associations, parties …);
- Relationship, kinship;
- Specific interactions (participation in conferences, visits …).

It is of interest (Jansen, 2003):

- Where are the actors in a network located? *Centrality*?
- Can an "inner circle" and an "outer circle" of actors be identified? How is the networking connection between them?
- How many combinations of theoretically possible connections exist?

Selected Network Analysis parameters – indegree and outdegree, betweenness centrality and status

A local centrality measure in directed networks is the sum of incoming communication links determined and described as indegree, abbreviated as id_j (Brandes and Wagner, 2004). Another measure of local centrality is outdegree (Brandes and Wagner, 2004). These are all outgoing links added up and abbreviated as od_i (Jansen, 2003).

Control over information can be expressed with the betweenness centrality (e.g. (Brandes and Wagner, 2004). Abbreviated *BC* in the literature, it is also just called betweenness (Jansen, 2003). This index is calculated depending on whether a player is a link between two other actors of the network functions (Real and Hasanagas, 2005). These broker positions can also connect people between different groups. The *BC* indicates how many communication links are transmitted by a certain actor, and thus would be lost if this actor would leave the network (Jansen, 2003). Thus, a high *BC*-value is also a sign of a monopolization of information and resource control (Real and Hasanagas, 2005).

According to WASSERMAN & FAUST (1999) status is an appropriate measure to display prestige in networks. The basic approach is a combination of the measure for the *rank* multiplied by the direct elections a player receives (such as id_j and od_i). A suitable visualization of various status concepts was developed by BRANDES & WAGNER (2004) through a characteristic status visualisation according to horizontal layers.

Visualisation of network data

In Figure 6 to Figure 8, the betweenness centrality is calculated uniformly and visualized in a radial layout. The link values interconnecting the nodes are emphasized by the strength of their "intensity of contact" (see Box 1 for interpretation).

Box 1: *Forms of visualisation – width and colour of interconnections*

1) The line width of the edge characterizes the "intensity of contact". Thick lines stand for "intense contact", very thin lines for "occasional contact". The other contact intensities lie in between. Along the thin edges the fewest communication processes occur. Where the respondents indicated to know the actor without being in contact ("know the actor but have no contact"), there are no edges defined as well as for the category "do not know the actor at all".

2) The colour of the edges characterizes the "degree in commonality in goals". The colour varies from light green for "shared goals" to dark green for "somewhat common goals", grey for "not common but not conflicting goals", dark pink for the "somewhat contradictory goals" until, finally, pink for "contradictory goals".

3) The height of objects symbolizes the outdegree-value, the width the indegree-value and the total area the communication intensity. Three colours of nodes represent agricultural actors (**A**; orange colour), environmental actors (**E**; green colour) and others (grey colour);

Visualisation and calculation is done solely for the stakeholders who returned the questionnaire and were included in the possible choices. That means, all stakeholders who did not complete the questionnaire were removed, including the links to and from them because incomplete information would distort the representation.

4.2. Results of betweenness centrality analyses

North: "Ahlenmoor"

The network of the northern study area *"Ahlenmoor"* in Figure 6 is made up of 23 actors – including only those respondents who were included in the possible choices in the questionnaire. Seven are grouped to be agricultural actors; five are environmental actors and eleven other actors.

Three actors reach high betweenness centrality-values and thus stay central in the depicted network structure. Most central remains the *Bog Conservation Centre*, abbreviated as ***E** III*. The duties, which it provides among others, are the promotion of the acceptance of nature conservation tasks among the population. Also close to the centre in the sociogram stands the *Department of Water, Coast and Nature Protection* of the provincial government (***E** V*) together with a third stakeholder from the environmental group; the local group of *Friends of the Earth Germany* (***E** IV*).

The farmers are far off the centre of the *BC*-visualisation. They show a low outdegree (height of the node) in contrary to a high indegree (width of the node).

Most actors in the *"Ahlenmoor"* are tightly interconnected. Interestingly, similar actor types, as for example agricultural actors seem to form a cluster in this representation, which also becomes evident for the municipalities.

When evaluating the interconnections, where pink colour represents "dominantly contradicting goals" and light green represents "dominantly common goals" on the other side of the scale, many connections visualize conflict to a certain extent.

The actors with a high betweenness centrality in the centre of the network stay in contact with opponents as well as with allies and thus are exposed to both types of intentions. Especially in the left side of the sociogram in Figure 6, many conflicting pink lines become visible.

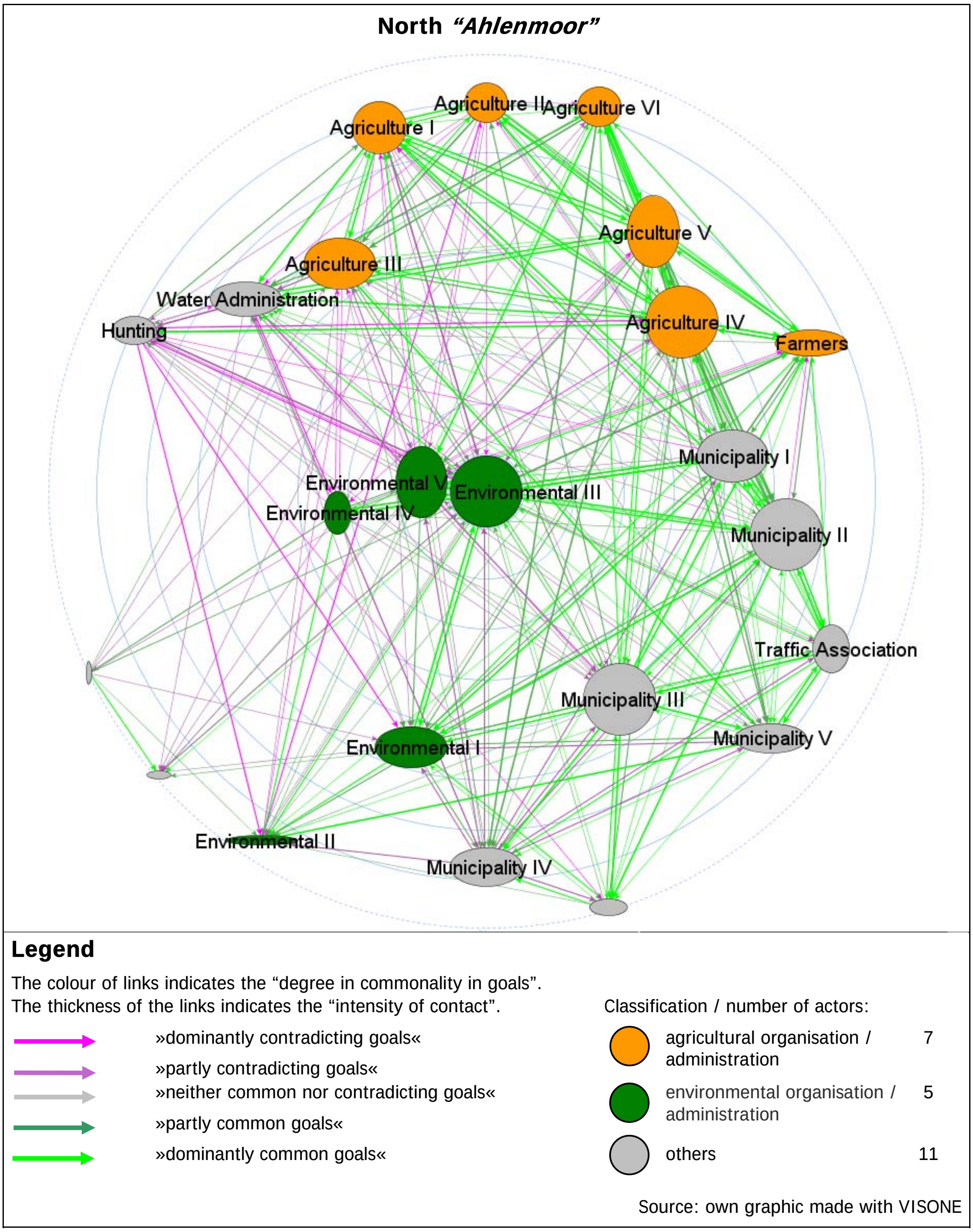


Figure 6: Visualisation of betweenness centrality, link value according to the "intensity of contact" for the northern study areas *"Ahlenmoor"*.

Looking on the individual intensions towards peatland protection and relevance of climate protection of the three most central actors, the following statements are given:

- ***E** III*: peatland protection is currently of <u>high relevance</u> and <u>further increase in relevance</u> is expected for the future. Climate protection is mentioned at <u>3rd prior-</u>

ity, out of the three possible priority choices, what peatland protection actually means for them.

- ***E** IV*: peatland protection is currently of high relevance and further increase in relevance is expected for the future. Climate protection has 2nd priority.
- ***E** V*: peatland protection is currently of high relevance and is expected to stay this way. Climate protection is mentioned at 2nd priority.

A main characteristic of the *"Ahlenmoor"* is the argument for the maintenance of recreational values.

East: "Rhin-Havel-Luch"

The network of the *"Rhin-Havel-Luch"* in Figure 7 in the eastern study area appears to be very loosely knit. Altogether 18 stakeholders – six from the agriculture group, three from the environmental group and nine others – were evaluated. Although a high number of actors are present in the *"Rhin-Havel-Luch"*, only few communication processes seem to occur.

The betweenness visualisation in the sociogram in Figure 7 for the northern study area puts actor III from the environmental group in the centre. The *Environmental Administration of the State of Brandenburg* has a high outdegree (height of node) and the highest indegree-value (width of node), showing a lively communication activity altogether. Similar, with respect to the *out*- and indegree, is actor ***A** VIII* from the agriculture group, standing for the *Ministry of Rural Development, Environment and Consumer Protection Brandenburg*. Two more stakeholders from the agriculture group are located in close vicinity to the centre, thus having a high betweenness centrality. These are the *Office for Agriculture and Veterinary* (***A** VII*), an administration on the district level, and a local *Water & Soil Association* (***A** III*).

Often farms in the study area jointly managed, typical for Eastern Germany, in contrast to the more individual management situation as for example in *Bavaria*. The farmers in the *"Rhin-Havel-Luch"* have a fairly balanced *out*- and indegree. An intermediate position is seen when studying the betweenness of the farmers.

Concerning possible differences in goals the results reveal only few contradicting goals. However, if the "intensity of communication" dropped below the threshold (i.e. at least some communication processes are absent or denied) the inherent contradicting goals stay invisible. This could be a result, if the views already diverge to such a degree that communication was discontinued, underlying conflicts do not become visible through this method.

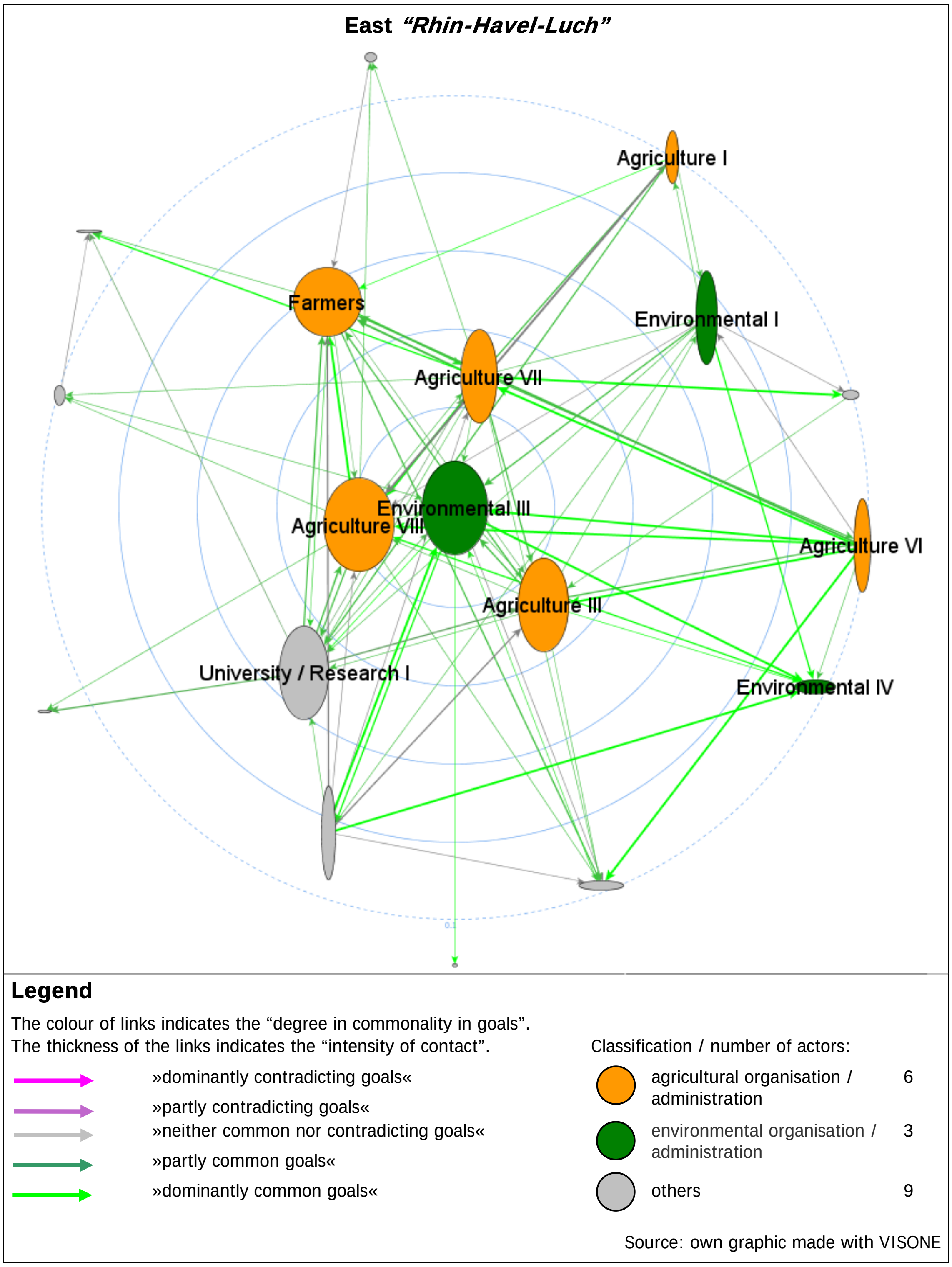


Figure 7: Visualisation of betweenness centrality, link value according to the "intensity of contact" for the eastern study area *"Rhin-Havel-Luch"*.

Four actors are identified to be a relevant authority according to their betweenness. Three of them belong to the agricultural group and one to the environmental group. The following statement with regard to peatland protection in general and relevance of climate protection were determined:

- ***A** VII*: peatland protection has a medium relevance at present and is expected to stay the same in future. Climate protection is mentioned at 1st priority, when asked, what peatland protection actually signifies.
- ***A** VIII*: peatland protection has a high relevance, now and in future and the climate aspect is mentioned at 3rd priority.
- ***A** III*: peatland protection is of medium relevance at present and is expected to decrease further in relevance. Climate protection is mentioned at 1st priority.
- ***E** III*: peatland protection has a high relevance and is expected to become more important in the future. The significance of climate protection is mentioned at 3rd priority.

South: "Freisinger Moos"

A dense and complex network of individual actors and groups is present in the South. A special situation arises from the settlement of the *Centre of Life Sciences Weihenstephan* and the *Bavarian State Institute for Agriculture* as well as the *Bavarian State Institute of Forestry* in the area. There is an obvious high density of natural science and environmental research-based local knowledge and expertise in and around the *"Freisinger Moos"*.

Three actors take central positions in the *"Freisinger Moos"*-network, according to their betweenness centrality. These are the environmental organisations ***E** I*: the *Countryside Association Freising* which organises landscaping measures, and ***E** VI*: the *Environmental Administration* at the county level. The third central stakeholder is the *LEADER-office*, which plays a role in coordinating various user interests.

The farmers as landowner in the *"Freisinger Moos"* occur partly as individual actors and also they are involved in different groups and associations. Some work is in line with the standards of organic farming. Their outdegree is very low but their indegree is high. The farms are positioned at the periphery of Figure 7 with respect to their betweenness centrality.

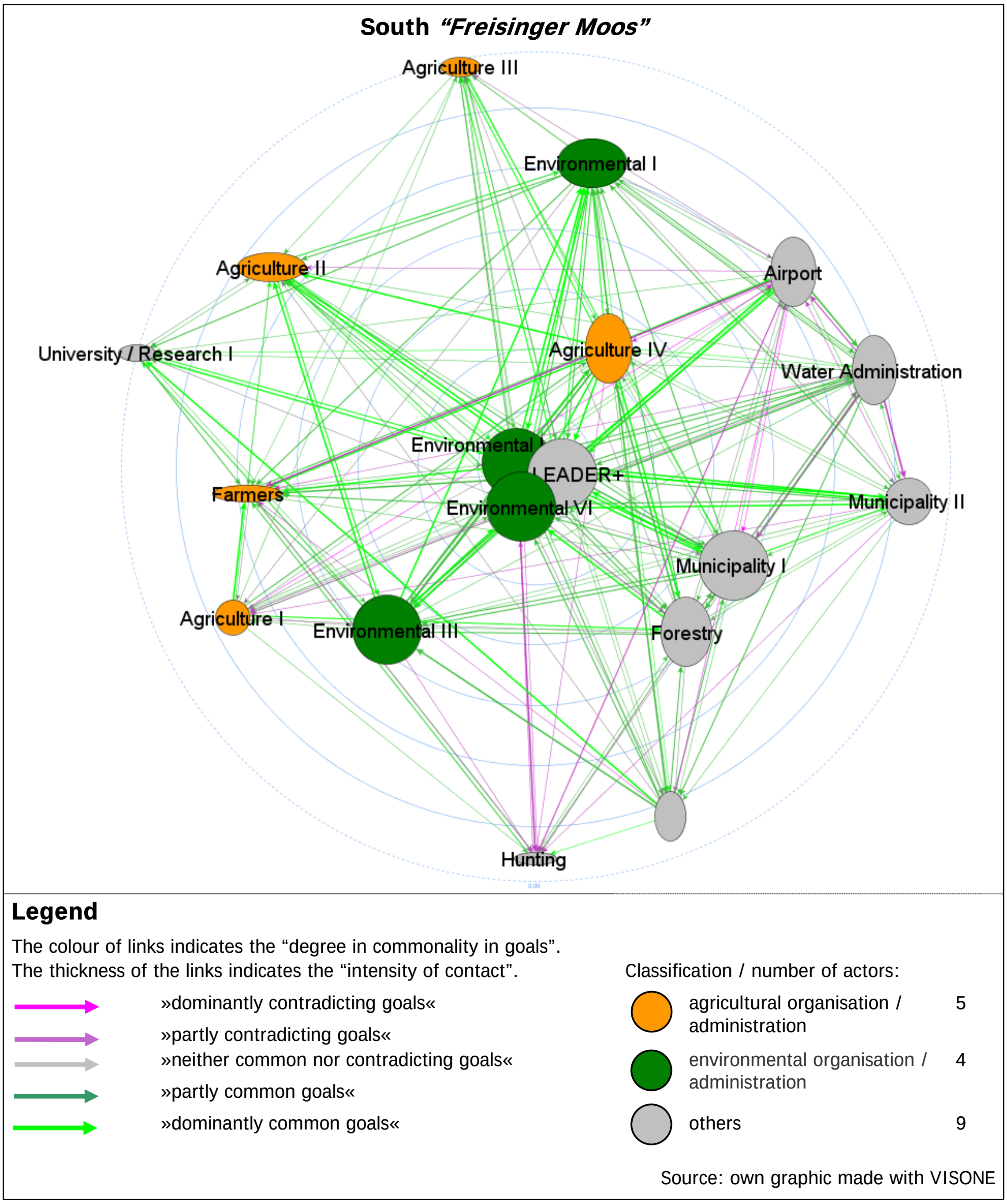


Figure 8: Visualisation of betweenness centrality, link value according to the "intensity of contact" for the southern study area *"Freisinger Moos"*.

The three most central stakeholders according to the betweenness centrality are obtained by two representatives from the environmental field and one from the so called "others". The evaluation of questionnaire results of the three central stakeholders with respect to the relevance of peatland protection and climate protection shows the following characteristics:

- ***E** I*: peatland protection is currently of high relevance and further increase in relevance is expected in the future. Climate protection is not among the first three priority choices with regards to the significance of protection.
- ***E** VI*: peatland protection is currently of high relevance and further increase in relevance is expected for the future. Climate protection has the 3rd priority.
- *LEADER+*: peatland protection is currently of high relevance and further increase in relevance is expected for the future. Climate protection has the 2nd priority.

The prevailing goals in peatland protection in the South generally are soil- & peatland protection, drinking water protection and nature protection.

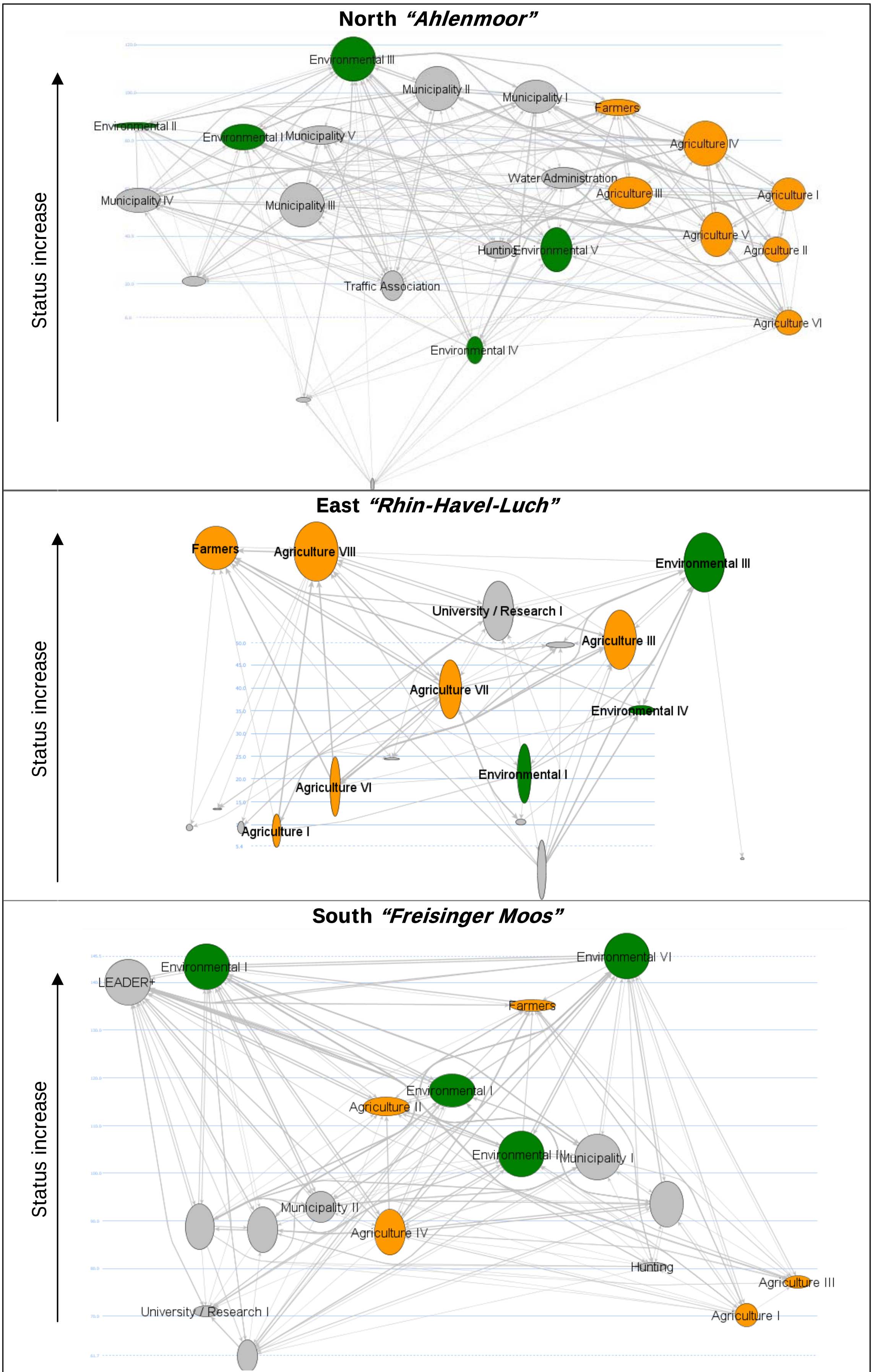
4.3. Differences in network structures between the study regions according tot status calculations

A different visualisation approach in form of a layered structure is chosen to represent the stakeholders' status in the networks (see Figure 9).

In the North, environmental actor ***E** III* captures the top position in the network due to its highest calculated status value. Two municipalities also reach high status-values. Agricultural actors are not present in the top-layer. The overall structure shows, that there are few actors in the very top and at the base of the graph with most concentrated in the space between.

In the East, three actors are in the top positions, including the farmers. The other two stay for representatives of the highest administrative level – the federal state of *Brandenburg*. The representation of agriculture is high on the top level. Furthermore, long distances between the top and the bottom actors turned out.

In the South, the same three actors that had the highest betweenness centrality are also located within the high status layer. Two stakeholders stay for representatives from the environmental field in the regional government level (***E** I* & ***E** V*) and one stakeholder is a non-governmental local networking office (*LEADER+*). So in the *"Freisinger Moos"* the positions with the highest status are dominantly taken by environmentally predisposed stakeholders. The overall structure in Figure 9 reveals a somewhat balanced distribution of stakeholders on all levels of status and from mixed political entities.



Source: own graphic made with VISONE

Figure 9: Visualisation of status according to the "intensity of contact" for all three study areas.

5. Discussion

Agricultural landscapes have economic functions in terms of productivity, but also social functions such as provision of recreational values (e.g. landscape aesthetics) and ecological functions (e.g. meadow bird habitat). One of the major future functions of land-use will be its contribution to climate change-remediation. This holds especially true for peatlands, because of their high relevance for the storage and production of greenhouse gasses.

Secondly, besides the different functions of landscapes, there are a number of stakeholders, pursuing a variety of interests in different land-use functions – sometimes conflicting, sometimes consistent.

The study tried to picture this multitude of stakeholders with reference to their multitude of interests. The goal is to study three representative peatland regions in the north, south and east of Germany and estimate whether climate friendly management options will be encouraged by the stakeholders or not.

5.1. General observations on the network level

On the network level, the situation in the North and South give evidence of far more closely integrated networks than expected. The eastern study site in the contrary shows a less developed network structure.

The second observation was that involved stakeholders are distributed along several administrative layers. Expectations of which stakeholders play central roles within the networks were largely confirmed by the results.

Third, the grouping into agricultural, environmental and "others" showed, that in the North and in the South, stakeholders from the agriculture group are not present among the actor with the highest status (except the farmers). In the North it's the municipalities, in the South it's the environmental stakeholders.

As expected, farmers are more being referenced to as they perceive to be in contact with the other stakeholders themselves. Farmers usually have more incoming connections than outgoing connections. Consequently, this stands in contrast to most of the local authorities, which usually have a higher outdegree than indegree.

5.2. Relevance of peatland protection and climate change among the central stakeholders

In the North, all three central stakeholders consider peatland protection of high relevance. Climate aspects are not a primary motivation of the central actors, and are mentioned among the 2nd and 3rd priority only.

The most central stakeholders in the East are three actors from the group of agriculture and one from the environmental group. Whereas the general necessity of peatland protection is recognized by the agricultural stakeholders on a comparably low level, climate protection as a driver was mentioned two times on 1st priority. Overall, the importance of the climate relevance is well recognized, but the local willingness is lesser developed. The actor from the environmental group is on the contrary strongly convinced on the worthiness of protection of the peatlands; however, climate protection serves only on the 3rd priority as reason for it.

For all central actors in the South, peatland protection currently is of high relevance and a further increase in relevance is expected for the future. Climate protection is generally of lower relevance but still mentioned.

6. Conclusion

A number of conclusions can be drawn from the study. It turned out, that numerous actors – individuals and institutions – consider the protection as well as the use of the peatlands as crucial, albeit with sometimes quite different objectives.

First, the network structure in the study area in the South and North of Germany are best established and extend across a wide range of stakeholders at different administrative levels. Surprisingly, the consideration of peatland protection as a possible contribution towards climate protection is not questioned and there is a considerable amount of goodwill. In the study area in Eastern Germany the situation is less favourable for climate mitigation measures by land-use changes and more evidence of conflict was found. The study area in the North ranges somewhere between the two others and represents a situation quite similar to what was expected initially.

In the North, the possibilities to move climate issues in the framework of peatland protection higher up on the agenda are considered very good, also because this does not stand in conflict with the primary goals of the stakeholders in the area. A considerable amount of goodwill and a strong vertical integration of the key-players exist.

A somewhat different situation can be found in the case of the East. Here a stronger horizontal separation became evident. Communication and interaction is weakened by a comparably low network density. In the East the structure of the network suggests a rather top-down approach, due to the ubiquity of the higher administrative levels. However, due to a comparatively lower interest in peatland protection amongst the most central stakeholders it will need more efforts to influence land-use policy towards climate protection.

The method of this qualitative network analysis is considered practical and produced valuable results for further research and policy advice. The data opens further possibilities in exploration. Especially interesting will be the combination and coupling of the structural network data with the qualitative data (triangulation).

References

Benta, M.I. AGNA Project: What is Network Analysis. (Available at: http://www.geocities.com/imbenta/agna/what_is_agna.htm; 2003).

Brandes, U. and D. Wagner "Netzwerkvisualisierung." it - Information Technology, Vol. 46, (2004) pp. 129-134.

Brandes, U. and D. Wagner "VISONE - Analysis and Visualization of Social Networks", in M. Jünger and P. Mutzel (eds.), Graph Drawing Software: Springer Verlag, 2004, pp. 321-340).

Drösler, M., Personal communication; (2008).

INSNA Webpage. International Network for Social Network Analysis Startseite. (Available at: http://www.insna.org; 2007).

Jansen, D. Einführung in die Netzwerkanalyse: Grundlagen, Methoden, Forschungsbeispiele (Opladen, Leske + Budrich, 2003).

Kohler, A., R. Würzbach and G.-H. Zeltner "Die Makrophyten-Vegetation des Fliessgewässersystems der Moosach (Münchner Ebene) - Ihre Entwicklung und Veränderung von 1970 bis 1996", in U. Arndt, R. Böcker, A. Kohler and W.A. Müller (eds.), Berichte des Instituts für Landschafts- und Pflanzenökologie der Universität Hohenheim (Hohenheim: Institut für Landschafts-und Pflanzenökologie Univ. Hohenheim, 1997, pp. 244-311).

Krebs, V. Social network analysis software and services for organizations, communities, and their consultants. (Available at: http://www.orgnet.com; 2007).

Laumann, E.O. "A 45-year Retrospective on Doing Networks." Connections, Vol. 27, (2006) pp. 65-90.

Real, A.T. and N.D. Hasanagas "Complete Network Analysis in Research of Organized Interests and Policy Analysis: Indicators, Methodical Aspects and Challenges." Connections, Vol. 26, (2005) pp. 89-106.

Schwärzel, K. "Dynamik des Wasserhaushaltes in Niedermooren", Fachbereich 7: Umwelt und Gesellschaft (Berlin: Technischen Universität Berlin, 2000).

Wasserman, S. and K. Faust Social network analysis: methods and applications (Cambridge, Cambridge Univ. Press, 1999).