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Relating physical and human geography

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The need for a more integrated approach between human and physical geography at university-level education in the Netherlands

De noodzaak van meer integratie van sociale en fysieke geografie in het universitair onderwijs in Nederland

Erik Meijles and Arie Stoffelen

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Introduction

- 1 Geography as a historically grown, yet always loosely delineated, discipline has broadly revolved around the study of the interrelation between people/societies and the spatial environment. However, the geography discipline has witnessed increasing polarization over time, characterized by a widening epistemological gap between social and natural sciences, which resulted in a widely documented (Massey, 1999; Viles, 2005; Goudie, 2017), reduced, and possibly still reducing 'middle ground' (Johnston, 1983; Castree, 2005) between physical and human geographical perspectives. We are currently living in a period increasingly referred to as the Anthropocene; a newly defined epoch progressively recognized by earth scientists (Zalasiewicz *et al.*, 2017; Steffen *et al.*, 2018). Sustainability debates are gaining momentum from global to local levels based on convincing empirical evidence that climate and environmental changes are pressing drivers of social and economic inequality (Levy, Patz, 2015; King, Harrington, 2018; Venn, 2019). Consequently, holistic perspectives bridging between human and physical

geography are useful for understanding these wide-reaching societal and environmental processes.

- 2 In this paper, we problematize the current conceptualization of geography within university Bachelor's and Master's degrees in the Netherlands, which is currently characterized by a strong division between human and physical geography with limited 'middle ground' between both. The Netherlands has a long academic history and renowned universities, resulting among others in high general and geography discipline-specific global university rankings. It is also a country whose co-evolution between people and space is high-profile. It does not encounter many large-scale natural hazards but is, like many other regions in the world, a country in which the co-evolution between humans and their environment, particularly but not exclusively at the land-water interface, has strongly shaped society. This has given form to a very visually recognizable system of settlements and land use patterns, as well as to the country's strong (socio-)spatial planning tradition. In addition, this same physical-historical background has had a strong influence on today's regional cultures and ideas and the institutionalization of how to manage landscapes. Combined with high population densities and a central spatial location in the core of the European economy positioned at sea level in a river delta, the country encounters many ongoing spatial development issues that require perspectives that integrate human and physical elements. It is, therefore, remarkable that education at Dutch universities adopts a particular, dichotomous view on the concept of geography, which rather marginalizes inclusive education dealing with the co-evolution between people and the physical environment.
- 3 Although it is not in the aim of this paper to provide a detailed historical perspective, it is relevant to have some historical context of the current dichotomous approach. For the Dutch situation, this can be traced back to the Academic Statute of 1921, in which the human geography ('sociale geografie' in Dutch) was recognized as an autonomous field of study, separated from physical geography, although many geographers at that time preferred a single field including both subjects (Heslinga, 1983). The Statute states that all universities should maintain the same levels of admissions and examinations and, most importantly in this context, follow the same compartmentalization (Heslinga, 1983). Through the last century, the different 'geographies' grew into their own institutes, their own spatial disciplines with their own research cultures, epistemologies and methods, and even their own buildings (De Pater, 2001). Although there have been several attempts to bridge the gap (e.g., Dietz, Kwaad, 2000; Dietz *et al.*, 2004; Mamadouh *et al.*, 2008), this did not lead to structural long-term collaborations thus far. Relatively recently, in his farewell speech at the VU in Amsterdam, Prof Van der Schee (2016) made it clear that in his view, geography is a broad, overarching field of study committed to solving sustainability problems by integrating the environmental and social aspects. Although he subtly mentioned 'geography' (implicitly meaning human geography) and 'earth science', he clearly steered away from the separation between the two in secondary education. For an extensive overview of the historical context of the twentieth century, readers are referred to De Pater (2001).
- 4 In this paper, we build upon this historical context by contemplating the current situation, the consequences thereof, and potential avenues for a future in which the human and the physical could be more integrated in the Dutch academic educational

system. We argue that separating the ‘social environment’ and ‘physical environment’ in education, such as is common practice in geography academic degree programmes in the Netherlands, limits the position of future geographers to tackle issues of global, regional and local changes in an integrative way. With such practices, the Dutch academic educational system is missing out on the otherwise strong potential of the discipline to connect natural and social scientists in sustainability questions.

- 5 In the following section, we present a short case study of the high-profile societal debate around human-induced earthquakes in the Dutch province of Groningen due to gas extraction. With this application, we introduce how the segregation between human and physical perspectives in Dutch geography studies limits establishing holistic approaches to very pressing societal issues that are at the forefront of recent media attention in the Netherlands. In the subsequent section, we deconstruct how geography is organized as an academic study in the Netherlands. We first identify which educational programmes are regarded to be ‘geography’, using formal educational classifications of the Dutch university system. We then pay attention to how the human and the physical foci in geography are included in curricula on the undergraduate and graduate level. We end the paper with suggestions for improving the situation towards the future.

Why the human and the physical should be integrated in Dutch geography studies: the example of human-induced earthquakes in Groningen, the Netherlands

- 6 In the northern-most region of the Netherlands, earthquakes and land subsidence have occurred over the last decades due to gas extraction (van Elk *et al.*, 2017). In 1959, a large gas field was discovered below large parts of the province, which later appeared to be the largest known field in Europe and the seventh largest in the world (Bommer *et al.*, 2017). In the decades following the start of the extracting in 1963, a high extraction rate was realized to maximize economic benefit, until it was shown that substantial land subsidence with a large spatial variation was a side effect, with the largest subsidence in the already relatively low-lying centre of gas extraction above the Groningen field (van Thienen-Visser, Breunese, 2015). The main problems related to the subsidence were rising groundwater levels in a predominantly agricultural area, and increased difficulties of expelling excess water in the land draining system. Since the land subsidence was a relatively slow process, problems could be solved following a technical approach in which the regional water boards adapted the physical water system, which was predominantly paid for by the gas extraction company (Jansen, Herber, 2017).
- 7 However, after some first earthquakes in the 1980s, the 2012 Huizinge earthquake led to a change in the gas extraction strategy, as it became clear that gas extraction was the cause of the earthquakes (Bommer *et al.*, 2017; Jansen, Herber, 2017). The earthquakes had many consequences, including social unrest and insecurity, and extensive physical damage to buildings, including homes, cultural and religious heritage and farm buildings. They also resulted in declining house prices in an area already characterized by unfavourable socio-economic characteristics and demographic decline (Haartsen, Venhorst, 2010), and a reduced trust in governmental

institutions (Van der Voort, Vanclay, 2015). Clearly, problems arose in both the social and physical domain. However, many technical solutions were sought from a sole earth sciences perspective, including a spatio-temporal change in gas extraction rates, increasing the spatial density of tremors measurements (Ntinalexis *et al.*, 2019) and relating them to geological fault lines and (historical) gas extraction rates. At the same time, research projects were started on geophysical and statistical modelling of earthquake and earthquake risk (e.g., Kruiver *et al.*, 2017; Vlek, 2018).

- 8 From a human perspective, the tremors fuelled socio(spatial) research, including into social unrest (Van der Voort, Vanclay, 2015), house prices (Boelhouwer, van der Heijden, 2018) and institutionalization of disaster management (Bakema, Parra & McCann, 2018). It is striking, however, that many of the solutions were brought forward by disciplinary specialists with limited notion of the broad spatial problems, especially during the onset. For example, in the popular discourse, there was a widespread call to reduce gas extraction. As a response, in 2014, the decision was made by the Minister of Economic Affairs to reduce the gas extraction at Loppersum, one of the main gas extraction locations. However, geophysicists warned that this would not necessarily help or would even increase induced local earthquakes because of differential pressure gradients in the gas reservoirs (Van der Voort, Vanclay, 2015), showing that close communication between or, better still, an integration of disciplines was important.
- 9 In another example, an earthquake Ground Motion Model (GMM) for the geological subsurface had been developed, in which the spatial variation in (unconsolidated) sediments was used to assess the spatial variation in the occurrence of earthquakes (Kruiver *et al.*, 2017). The area of study was subdivided into geological zones, which represented the majority of the geological variation in the area. However, the landscape of Groningen is characterized by the occurrence of terps: anthropogenic dwelling mounds constructed between the Iron Age and Late Medieval period as a defence against flooding (Bazelmans *et al.*, 2012; Nieuwhof *et al.*, 2019). These mounds take up very little space and the total area of terps is limited in percent cover, with only 0.6% of the landscape above the gas field in the province of Groningen taken up by terps. As a consequence, they may seem less relevant and can easily be seen as not representative from a geophysical point of view. However, its number of over 900 in the province of Groningen alone shows their significance. They form the village centres, and consequently have relatively high population densities. In addition, the majority of the built cultural heritage monuments are located on the terps, including 12th century churches, typical regional housing and village layouts with high heritage values (Bazelmans *et al.*, 2012). Therefore, it was realized that the terps, consisting of unconsolidated material, should be added to the GMM (Aalbersberg, Meijles, 2020; Kruiver *et al.*, submitted). It became apparent that even when creating a highly technical physical earthquake model, a strong human geographical component is required to represent the full geological, anthropogenic and socio-cultural variation of the subsurface and landscape at the surface.
- 10 This case study shows that many different specialized disciplines within the geographical domain were involved in attempts to solve the earthquake-related problems, both in terms of research and in public discourse. These included (but are not exclusively) geophysicists, exploration engineers, quaternary geologists, geomorphologists, hydrologists, economic geographers, sociologists (with or without a spatial approach), real estate scholars, cultural geographers and spatial planners.

However, in many instances, they were not or poorly integrated. In the model development process, it became clear that it was not only needed to bring together a broad spectrum of different disciplines, but having geographers with an interdisciplinary and broad background in the research team would have made the process more efficient and the results of a higher quality (Kruiver *et al.*, submitted). Tellingly, the earthquake problem features as a case study in the profile text of the Earth Sciences programme at the VU in Amsterdam and is also featured in the Human Geography bachelor programmes in Groningen (see below for a discussion of these programmes). This particular example is, thus, clearly relevant for both physical and human geographers. However, as we will show, the institutional separation of geography (sub)domains within degree programmes in Dutch universities hinders students from getting the holistic overview that appears clearly needed on the basis of our description above.

- 11 This case study adds to the notion that a more interdisciplinary view is not likely to be fostered simply by better stakeholder communication or project management. There clearly is a strong need for all-round geographers, who have broad knowledge covering a range of the disciplines above, are able to bridge the gaps between the different spatial disciplines, and have the knowledge and skills to understand possible problems and their solutions in adjacent, spatially oriented disciplines. They would be able to identify, translate and communicate knowledge, theories and skills from one discipline to another, and could also identify differences in interpretations of similar terminologies or theories between disciplines. At the same time, they should be capable of listening to specialists and interpreting the knowledge from the different disciplines. However, as we show below, there are systemic issues in the Dutch higher education system that hinder delivering such integrated skills.

The position of geography in the Dutch university educational system

- 12 The Association of Universities in the Netherlands (*Vereniging van Universiteiten*, VSNU) is the umbrella organization of the ten government-funded research universities in the Netherlands and the distance-learning based Open University. The programmes delivered by these universities, which are officially recognized by the Dutch Ministry of Education, Culture and Science, are registered in the Central Register Higher Educational Programmes (*Centraal Register Opleidingen Hoger Onderwijs*, CROHO). In this database, every programme is recognized with an identifier and positioned in a two-tiered classification system. The first tier consists of ten sectors identified by the CROHO inspection itself. The subsections are based as much as possible on the International Standard Classification of Education system (ISCED) of UNESCO.
- 13 In order to be funded by the government, every programme needs to be formally accredited every six years. The accreditation body is the NVAO (*Nederlands-Vlaamse Accreditatieorganisatie*), which operates as an independent quality control organization. The NVAO pools the accreditation process between Dutch universities and the universities in the Dutch-speaking Flemish Community in Belgium. Changes to the CROHO registration, including name and profile changes, can only be done at the formal accreditation moments. The accreditation procedure is performed by domain-

specific visitation groups, consisting of people working in academia in similar domains in both countries as well as student representatives.

- 14 A clear disciplinary divide appears when looking at how geography is included in the CROHO classification system and the NVAO accreditation process. Programmes in the human geography and spatial planning disciplines fall under the 'Behaviour and Society' CROHO sector. Most human geography and spatial planning programmes are grouped in a specific subsection labelled 'geography' (without a prefix like 'human', 'social' or similar), in contrast to the NVAO domain-specific visitation group for some of these programmes that is labelled 'Social Geography and Planning'. Despite this specific name, which is a literal translation from the Dutch 'sociale geografie', we refer to 'human geography' instead of 'social geography' in this paper to use the most inclusive concept. This is particularly relevant for the Dutch situation as spatial planning is normally considered part of the discipline, in contrast to other countries where spatial planning is often considered part of architecture.
- 15 Physical geography programmes are grouped under the CROHO sector 'Nature', with subsection 'Earth Sciences'. Although earth sciences is a broad field studying all natural aspects of the earth, it is striking that in contrast to the human geography-oriented programmes, none of the Bachelor's and Master's programmes are named 'geographical', although they fall within the classical physical geographical framework. We consider physical geography here as studying the present and past physical, chemical and biological processes determining the features and landforms of the earth, which includes spatially varying factors such as weather, climate, soils, water and oceans.
- 16 A third CROHO sector that includes programmes that overlap considerably with the geography domain is 'Agriculture and Natural Environment', which includes a 'Landscape' subsection that includes programmes like 'Urban Environmental Management', 'Soil, Water, Atmosphere' and 'Earth and Environment'. All these programmes are based at Wageningen University. Finally, an interdisciplinary CROHO sector called 'Transcendent' includes a few broadly based, transdisciplinary programmes with some overlaps in terms of scope to geography programmes, including programmes that focus on global change, sustainability and international studies.
- 17 Although we only focus on academic geography education here, it is important to know about the backdrop to which potential Bachelor's students choose their geography programmes. At Dutch secondary schools at pre-university education level ('VWO'), pupils need to choose after three (out of a total of six) years for a single profile out of four options: 'Culture and society', 'Economics and society', 'Nature and health' and 'Nature and technics'. Geography is an optional course in the first three, but is not generally included as an optional course in the 'nature and technics' profile. Interestingly, physics and chemistry, key courses in the nature and technics profile, are compulsory courses on a high school level for prospective undergraduate students Earth Sciences. Consequently, this means that many of the students starting with their undergraduate programme in earth sciences only followed three years of geography at the lower secondary school level when the course is still compulsory for all, and not in the final three years of their high school education. With geography being more strongly embedded in the two social/economic secondary school profiles, the

geography course is already a predominantly social sciences course with a few physical geography modules at high school level.

- 18 The separation of human and physical geography into CROHO classifications, the organization into accreditation committees, and the somewhat hidden and unbalanced position of geography at the upper high school levels marks the clear disciplinary divide between physical and human geography institutionalized in Dutch university-level education. In terms of semiotics, the classification of geography in the ‘Behaviour and Society’ CROHO sector signifies that the discipline is viewed as the realm of the social sciences and even humanities, which is a statement to which many (physical) geographers would object. This classification, combined with the use of the word ‘geography’ without prefix, suggests that the physical environment is not part of the subject matter of geography or, if it is, only by extension. Conversely, the absence of the word ‘physical geography’ in particular and even ‘geography’ in the CROHO classification implies that earth surface processes and landscape studies are (unintentionally) the domain of geophysicists, geologists, environmental scientists and bio-engineers, in a sense ignoring or underplaying the spatial component. The CROHO classification indicates the deep-rooted institutional separation of the geography discipline in the Netherlands.

Deconstructing geography as an academic study in the Netherlands

- 19 To deconstruct how geography is organized as an academic study in the Netherlands, we analysed the profile and content of geography programmes. We first identified all academic programmes that can reasonably be regarded as ‘geography’ (or related) using the CROHO classification scheme (Inspectie van het Onderwijs, 2017). Considering the number of programmes, we selected the two main CROHO sectors (‘Behaviour & Society’, subsector ‘Geography’ and ‘Nature’, subsector ‘Earth Science’) that cover the main geography perspectives. We also included the CROHO sector ‘Agriculture and Natural Environment’, subsector ‘Landscape’, because the concept has a central position in both human and physical geography in the present but also in the past. Some programmes positioned under this CROHO label are part of the NVAO accreditation domain of Earth Sciences, backing up our decision to include them in our analysis.
- 20 Subsequently, we summarized the profile of all listed programmes. We used the available online profiling texts as well as the available curriculum overviews to summarize the programmes’ visions on human and physical perspectives, and whether and how integrative perspectives between both are present in the text. We then synthesized our descriptions by assessing whether the programmes are ‘broadening’ or ‘specialized’ in terms of content; in other words, whether the programme provides diverse perspectives on the discipline or zooms in on a specific theme within the discipline.
- 21 In addition to the profile study, we carried out a content analysis of all programmes’ web profiling texts for terms explicitly or implicitly indicating the spatial orientation of the programmes. Without aiming to provide an all-encompassing definition of the discipline, we believe that the attention to the spatial embedding and variability of processes set geography apart from other, related disciplines. Consequently, we

performed a word search on all online profile texts for key indicators of geography discourses. We regarded (conjugated) terms such as 'geography' or 'geographical', 'spatial', 'maps', 'environment' and 'landscape' to be explicitly geographical. In addition, we looked for more implicit geographical terms, such as 'local', 'geo-', 'earth (surface) (processes)', 'geophysical (processes)', 'region', 'environmental', 'scale', 'urban and rural', 'migration', 'pattern', 'distribution' and 'dispersal'. We also used more methodologically oriented search terms, such as 'GIS', 'geo-information' and 'location-based services'. All Dutch terms were translated into English for this paper.

- 22 We initially aimed to classify and quantify the individual courses within all programmes as focusing on 'human', 'physical' or 'integrative' perspectives on the basis of the course titles. However, we chose not to include these data for all programmes. First, it proved impossible to define absolute criteria for deciding how a course should be classified. The classification would be importantly shaped by the rules of inclusion set by us or would need careful scrutiny of all available course manuals, which we considered to be beyond the scope of this study. Second, we encountered a similar issue as we did when deciding on which programmes fall within the geography domain: delineating the boundaries of which courses could be labelled as 'geography' courses proved difficult. Finally, because of strong specialization, many Master programmes include a range of specializations and tracks. Quantitative analysis of the number of courses along all programmes, thus, does not well represent the general orientation of the subject field as some programmes dominate the classification. For the above reasons, we limited ourselves to the classification of courses only for some of the 'core' geography programmes in the Netherlands that are part of the NVAO accreditation domains 'Social Geography and Planning' and 'Earth Sciences', serving purely as illustrations for the positioning of the geography discipline at Dutch universities.

Broad Bachelor programmes, specialized Master-level education

- 23 The overview provided in Table 1 reflects that geography is formally classified at Dutch universities as being either human or physical in orientation. Under the Behaviour and Society CROHO labels, most Bachelor programmes include the term 'human' or 'social' in their names, and at the Master's level, terms such as 'economic', 'cultural', 'urban', 'human' and 'real estate' have strong connections to only the human aspects of geography (Supplementary Table 1; see appendix). For Bachelor's programmes under the Nature – Earth Sciences label, most names refer to 'earth' or 'environmental' only. At the Master's level, terms as 'earth', 'hydrology' and 'marine' have strong association with the physical aspects of geography. It is striking, however, that specifically the term 'environmental' is used in the context of both the human as the physical geography-oriented programmes, both at the Bachelor's and at the Master's level. Programmes at Wageningen University form a special case. Based on the titles, the content of many programmes here seems to bridge between human and physical geographical perspectives. Yet these programmes are not positioned under the classic geography CROHO labels but have been assigned to their own, exclusive CROHO sector (see above). The background of this division is related to funding in the past. Wageningen University was originally funded by the Ministry of Agriculture, whereas all other universities had their financial basis in the Ministry of Education. When the

funding of all programmes was pooled at the Ministry of Education, programmes at Wageningen University retained their separate classification in the CROHO system.

Table 1. Overview of the interdisciplinary position of geography-related degree programmes in the Netherlands.

CROHO	Number of programmes	Presence of both human and natural science perspectives		
		Absent	Minimal	Clearly present
Behaviour and society – geography	BSc: 6	1	4	1
	MSc: 17	10	6	1
Nature – earth sciences	BSc: 4	2	2	0
	MSc: 11	4	7	0
Agriculture and natural environment – landscape	BSc: 5	2	0	3
	MSc: 7	1	3	3

- 24 In terms of title and content based on the web profiling texts, Dutch undergraduate (BSc) programmes in geography are rather broad in their orientation and in the topics covered. However, they are not so broad that human and physical questions are included equally or integratively. Supplementary table 2 (see appendix) shows that graduate (MSc) programmes are generally more specialized with a wide range of different topics of study and specializations. Across the whole spectrum of Bachelor's and Master's programmes that could logically be listed as part of the geography domain, it was striking that geography is not often explicitly mentioned as the main field of study in online vision and profile texts as well as in terms of content of curriculums. The exceptions were the 'core' programmes dealing with human, economic, cultural and/or social geography and socio-spatial planning. Physical geography as a term is marginal altogether, appearing only a few times in profile texts and replaced in course titles by either general 'earth sciences' or the very specific 'soil geography' in some Wageningen-based programmes (Supplementary table 2).
- 25 Logically, of the Bachelor's and Master's programmes under the Behaviour and Society – Geography CROHO label, nineteen programmes specifically refer to the spatial context of the subjects studied, using the terms 'geography' or 'spatial' in their profiling texts. The remaining six programmes use the more implicit 'environment'. Other often-used references include 'global' to 'local scales', 'rural' to (more often used) 'urban' settings, 'regional' and 'spaces' or 'places'. The term 'landscape' is hardly used by the programmes under this CROHO label. In the programmes under the Nature – Earth Sciences CROHO label, the spatial references were considerably less common and less explicit. Four out of fifteen programmes used the term 'geographic' and/or

'spatial', whereas the spatially less explicit term 'environment' was used more often (seven out of fifteen). Like in the human geography domain, the term 'landscape' is used only in a few instances. In this context, apparently 'earth' and 'geo' may be used as spatio-scale indicators, as virtually all programmes here use these terms in their profiling texts. For the twelve exclusively Wageningen-based programmes under the CROHO label Agriculture and Natural Environment – Landscape, the references to the spatial aspects of their study was limited to 'environment' and 'geographical' (mentioned by six resp. four programmes). Surprisingly, only three programmes mentioned 'landscape' in their online profiling texts, and two programmes did not clearly relate to geography.

- 26 Despite the clear subdivision of geography into human and physical spheres, the connection between social and natural sciences is not absent. This bridge almost always centres around general sustainability and environmental management questions, such as climate change (management), land degradation issues, or pollution problems (Supplementary tables 1 and 2). If anything, physical geography-related programmes and technical spatial planning are more likely to incorporate human perspectives in profile texts than human geography-related programmes are to include physical perspectives. However, when including human issues, programmes at the physical side of the discipline appear to approach societal topics from a technical approach instead of from a socio-spatial worldview that zooms in on the social, economic and cultural backgrounds through which certain earth surface processes take place. This view translates into profile texts in remarks such as:

“You’ll learn to apply field measurements and theory to estimating water risk for society, while exploring management options to reduce risk” (MSc Hydrology, VU Amsterdam).

“In this programme, you will learn how to analyse the processes associated with change and will consider the short- and long-term management of these processes on local and global levels” (MSc Sustainable Development, Utrecht University).

“The Master’s track Environmental Management typically aims to improve land and geo-ecosystem management strategies by combining scientific knowledge with societal aspects of land management (policy making, stakeholders, conflicts of interest)” (MSc Earth Sciences, Uva Amsterdam).

- 27 This perspective on human activity translates into courses in natural sciences programmes focusing on the technical management of, and public policy interventions dealing with, human-induced impacts. For example, the profile text of the BSc programme Earth Sciences at Utrecht University includes some examples that highlight the societal relevance of physical environmental problem solutions:

“How do we keep our feet dry in the Netherlands, when it starts raining more frequently and harder? Is storing CO₂ deep underground a good solution for the future? How do we avoid pollutants in the groundwater ending up in our drinking water?” (BSc Earth Sciences, Utrecht University).

- 28 In the curriculum of the same programme, a total of 44 compulsory and optional courses are physical geography-oriented, none appear to focus on human geography, and three courses bridge between human and physical perspectives. Likewise, the profile text of the BSc Earth Sciences at VU Amsterdam includes some tentative remarks to explain the societal importance of the physical geographical perspective, for example regarding drinking water safety and availability:

“Are you interested in natural processes, such as volcanism, climate change, earthquakes, floods and the origin of mountains? Do you want to know for how long

there still is clean drinking water for everyone? What effect does climate change have on the sea level and river levels? What about the soil beneath our feet?" (BSc Earth Sciences, VU Amsterdam).

- 29 In this programme's curriculum, 34 courses are physical geography-oriented. One course's focus is on human geography (an elective) and two bridge between human and physical perspectives (of which one elective).
- 30 Programmes at the human side of the discipline tend to not include physical geography. In the cases that they do include physical geographical perspectives, these are mostly included as a (passive) framework for action but not as an educational component in which the processes that make up the physical systems or spatial patterns are taught. For example, based on the profiling text, the BSc programme 'Social Geography and Planning' at Utrecht University appears to have a human-centred focus on spatial issues at the local/regional scale, almost exclusively in urban settings. The programme presents a spatial problem-solving approach for local communities. The only physical component in the profile text is the term 'climate change', which is presented as a backdrop for attention to socio-spatial processes:
- "[Human geographers and planners] link global processes like climate change or technological innovations to changes in streets, neighbourhoods, cities and countries" (BSc Social Geography and Planning, Utrecht University).
- 31 In the curriculum, 22 courses have a human geography orientation, one course bridges between human and physical geography, and purely physical geography courses are not apparent from the sources we used. In the Groningen-based programme Human Geography and Urban and Regional Planning, only the mentioning of 'sustainable societies' in the profile text hints towards a focus on physical geographical processes:
- "Do you believe you can help to further develop our world into a sustainable society? Then Human Geography & Planning may be the right choice for you" (BSc Human Geography and Urban and Regional Planning, University of Groningen).
- 32 The curriculum consists of eleven human geography and spatial planning courses, one physical geography course and one course that explicitly bridges between both sides, using 'landscape' as a unifying concept. In the Spatial Planning and Design Bachelor's programme, also in Groningen, the compulsory programme consists of eight courses on human geography-related subjects and a single course addressing physical geographical subjects relevant to human geographers. In addition to the same Landscapes course in the other geography Bachelor here, other courses address the connection between physical and human geography, of which the Water and Planning course is most explicit. Technical water issues including quantitative hydrology as well as a qualitative ecohydrological approach are included here, and are combined with a strong socio-institutional water management approach.
- 33 It was striking that programmes that do bridge between the natural and social sciences hardly ever use geography discourses. In most cases, attention to the natural/physical environment is covered by courses on the more technically oriented environmental sciences (*milieuwetenschappen* in Dutch), as could be seen from the regular use of 'environment-' even in programme titles in Supplementary Tables 1 and 2. In these programmes, social science perspectives are predominantly approached from a technical public policy or management approach. In fact, several Wageningen-based programmes, despite falling outside of the classic geography CROHO sectors, most explicitly pitch that they combine natural/physical and human perspectives:

“Learn how to investigate environmental issues like pollution, study on climate change and depletion of natural resources from a natural and social scientific perspective, and explore innovative sustainable solutions” (BSc Environmental Sciences, Wageningen University).

“Are you interested in developing plans for sustainable crop production on healthy soils with local farmers in Burundi? Would you like to investigate how the growing thirst of Lima threatens the livelihoods of Andean farmers? Or would you like to be involved in the co-creation of scenarios for sustainable use of the flood plains of the Rhine in the Netherlands?” (MSc International Land and Water Management, Wageningen University).

- 34 Yet even these programmes, which we interpreted to be interdisciplinary and include natural and social sciences, almost never include both human and physical geography courses within one curriculum. This issue explains why our attempt to classify individual courses into human–physical–integrative domains proved futile.

Suggested directions for more integrative future geography education in the Netherlands

- 35 By definition, geographers are in a prime position to bridge between social and natural sciences, considering that a focus on space and place is central throughout the domain and its specializations. Global, wide-reaching societal and environmental problems have shown that there is a shared nature of contemporary geographical scholarship (Johnston, 1983; Van der Schee, 2016). Yet, the ability to actually take up this bridging role has remained a key point of debate in academic education. Almost two decades ago, Viles (2005) sketched three scenarios for possible development of the geography discipline: (1) integration between human and physical perspectives by focusing on shared topics like natural hazards, methodologies like GIS, and shared points of departure like the shared interest in space-time and scale/hierarchy; (2) a clean break between both, and (3) continuing with an uneasy co-existence – arguably the current form of physical and human geography in the Dutch academic education system.
- 36 Building on the analysis of how geography is organized as an academic study in the Netherlands, we argue that the three scenarios presented above are too categorical. In our view, a key skill of geographers is to be able to at least have an overview of the breadth of the discipline without having to be a *homo universalis* whose expertise spans across all geography focuses. Particularly the regional case study on earthquakes shows that there is a strong societal need for broadly educated geographers who do not, a priori, make value judgements on which topics and associated methodologies constitute ‘proper’ (applied or fundamental) research. Setting several experts from different disciplines around a table to discuss problems and solutions associated to spatial questions like the Groningen earthquake example will more than likely not lead to inter- or transdisciplinary solutions considering their different backgrounds, visions and philosophies of science. Such situations require bridge-builders; people who are aware of, have a broad overview of and can critically reflect on different domain-specific interests, jargon and methodologies. Educating these bridge-builders should be one of the core tasks of geography-related undergraduate and graduate programmes. This does not even necessitate establishing a unified discourse regarding philosophies of science or methodologies that all should adhere to. Nevertheless, we have shown that the Dutch academic educational system has clear limitations in this regard, even

though human and physical issues are included in geography on a high school level and some university programmes include individual courses from ‘the other side’ of the geography domain.

- 37 Practically, regarding the Dutch situation, we see several possible directions to deal with the current limited integration between human and physical geography:
- 38 At the very minimum, we are of the opinion that some human geography courses should be included in earth sciences programmes and, vice versa, some physical geography courses should be part of human geography and spatial planning programmes.
- The full range of (monodisciplinary, multidisciplinary, interdisciplinary and transdisciplinary) geography degree programmes should be available in Dutch geography higher education. We have noted that a large variety of mono- and multidisciplinary oriented programmes already exist, but there is a clear need for further fully integrated programmes, both at the Bachelor’s and the Master’s level.
 - In addition to this, students could be actively encouraged to fill in their Bachelor’s minor space with courses from ‘the other side’, without stressing that there is ‘either’ human geography ‘or’ physical geography. This could mean that human geography students would be stimulated to follow physical geography courses as a minor and vice versa. This automatically implies that such courses should be available at the right level for them to follow. Considering that undergraduate programmes in human geography and earth sciences are regularly organized at different faculties within the same university, administrative flexibility may be required for this.
 - At least one fully integrative BSc degree programme covering the full width of ‘geography’ should be considered to be made available at the national scale.
 - Although not fully studied within the scope of this paper, we also suggest that at the high school level, the explicit and implicit labelling of ‘human’ and ‘physical’ educational modules by geographical textbooks and teachers does not help in profiling the width of the geography discipline. Already early on, geography should be presented as an overarching discipline able to explore the links to other courses like chemistry, physics and social studies.
- 39 We are not suggesting in this paper that human and physical geography should always and everywhere be merged into some sort of a single field of study. We are of the opinion, though, that a group of geographers is needed that can fully bridge the gap. In our opinion, this does not mean that we have to choose between one or another epistemology or prefer one methodology over another. This is not about a ‘decisive shift’ of the centre of geographical gravity, or a discussion ‘on whose terms’ we should address wide-reaching societal and environmental problems. It should be considered as a contribution to the discussion about how we can establish a broader geographical approach in our academic education.
- 40 We are aware that implementing some of the above-mentioned suggestions could give rise to difficulties associated with the vastly different research cultures and epistemologies that characterize human and physical geography in the Netherlands. One of the main problems is how clearly integrative topics like climate change, natural hazards or resource use should be examined or discussed in class. Even though we argue that developing integrating geography courses is not about ‘on whose terms’ certain topics should be studied or approached, such discussions may be hard to avoid especially in practice when subdiscipline-specific experts are forced to collaborate.

Practical issues provide further complications. These practicalities could range from who should or is even able to teach integrative courses, under which faculty integrative degree programmes should fall, what to do with supplementary disciplines like geology and spatial planning, or even whose building to use. Consequently, the widening epistemological gap between social and natural sciences that has led to the polarization between human and physical perspectives within the geography discipline is not likely to be solved in a short time period.

- 41 The fact that the institutionalized gap between human and physical geography in the university education in the Netherlands has a long history does not mean that we should not challenge the current situation. At the very minimum, the debate around this topic should be reinvigorated within Dutch geography-related academia. When it comes to education, where the foundation for people's worldviews and future academic research is laid, countries with geography education systems similar to the Netherlands stand to gain from strengthening the discipline's 'middle ground' (Castree, 2005) on top of existing attention to specific specializations. In a world characterized by global change, including climate and environmental change that are drivers for socio-spatial inequalities and livelihood effects from global to local scale levels, the integrative aspects of the geography discipline in academic education should be embraced.

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APPENDIXES

Supplementary Table 1. Overview of geography-related university programmes in the Netherlands on a Bachelor level, and their incorporation of human/physical geographical reflections. The list of programmes is derived from Inspectie van het Onderwijs (2017).

CROHO	Programme	University*	Vision on social/human perspectives in geography	Vision on physical perspectives in geography	Level of social-physical integration	Focus**

Behaviour and society – geography	Human Geography and Urban and Regional Planning	RUG	Socio-spatial focus, incl. human & economic geography, spatial planning, demography.	Not included in the profile texts but a few physical geographical courses.	Not specifically acknowledged. Within a focus on 'sustainable societies', only attention is paid to socio-spatial processes.	B
	Spatial Planning and Design	RUG	A technical spatial planning focus with a few human geography courses.	Focused on water and environment, with basic physical geography, hydrology.	Integration between living environment and climate change is mostly approached from water management / technical planning.	S
	Geografie, planologie en milieu	RU	Broad focus on spatial problems for sustainable societies.	Only in the context of 'environment', which is not further defined.	Not specifically acknowledged, although the term 'environment' is to be interpreted as physical aspects that influence social systems.	B
	Sociale Geografie en Planologie	UU	Human-centred focus on spatial issues at the local/regional scale, in urban settings.	Only presented as a framework, but no education on physical systems.	Issues like climate change are only mentioned as a backdrop for socio-spatial processes.	B
	Milieu-maatschappijwetenschappen (inactive)	UU	Social aspects of environmental change. Human geography as an elective.	Mostly focusing on the environment. Physical geography is absent.	Centres around environmental policymaking. Explicit reference to the intersection between people, society and environment.	S

	Sociale Geografie en Planologie	UvA	Global-urban focus, with attention to inequality and political-economic geography.	Only climate change is presented as a framework for global (social) change.	Climate change is mentioned as one of the domains of human geographers and spatial planners but this is not developed further.	S
Nature earth sciences	Milieu-natuurwetenschappen	OU	As a backdrop, to highlight problem-solving for environmental degradation issues.	Natural science focus on environmental degradation incl. some physical geography.	Natural sciences are complemented with social views to discuss consequences of and adaptation for sustainability.	B
	Aardwetenschappen	UU	As a backdrop, incl. examples to show social relevance of physical problems.	Strong focus on earth sciences as natural science.	Limited to physical, not social aspect of people, such as people as geological agents or as a causing factor in land degradation.	B
	Milieu-natuurwetenschappen (inactive)	UU	Focus on public policy and governance instead of human geography.	Environment and environmental assessment, more technical than physical.	The interface between environment, earth, climate and society is mentioned in the profile text as a backdrop to natural sciences.	B
	Aardwetenschappen	VU	As a backdrop to explain the societal importance of the physical geography.	A natural science perspective is central to this program.	Some consequences of the earth system for society (drinking water, sea level rise) but only as a backdrop.	B

Agriculture and natural environment – landscape	Environmental Sciences	WUR	Social science perspectives regarding environmental mitigation and adaptation.	Natural science core of the programme with physical geography regarding soils, water.	The interdisciplinary perspective of the programme is mentioned as being key, centring around sustainability and resource use.	B
	Forest and nature conservation	WUR	Conservation, public administration, law. No human geography.	Mostly referring to soil sciences.	Focus on forest conservation, including of some social science perspectives on use management.	B
	International land and water management	WUR	Social science aspects refer to stakeholder interactions and livelihoods creations.	Strong natural science foundation including soil science, hydrology and agro-ecology.	Explicit link between technical and social sciences, focusing on the implications of drought, erosion, flooding, land management.	B
	Landschapsarchitectuur en Ruimtelijke Planning	WUR	Strong human geography perspectives, incl. cultural and historical geography.	Environmental sciences and physical (landscape) geography.	The landscape is the bridging element in the profile text.	B
	Soil, water, atmosphere	WUR	Socio-spatial issues only as a backdrop (climate change, flooding, drought).	The program covers hydrology, meteorology soil science.	Absent.	B
* RUG: University of Groningen; RU: University of Nijmegen; UU: Utrecht University; Uva: University of Amsterdam; VU: Vrije Universiteit Amsterdam; OU: Open University; WUR: Wageningen University. ** B = broadening, S = specialized.						

Supplementary Table 2. Overview of geography-related university programmes in the Netherlands on a Master level, and their incorporation of human/physical

geographical reflections. The list of programmes is derived from Inspectie van het Onderwijs (2017).

CROHO	Programme	University*	Vision on social/human perspectives in geography	Vision on physical perspectives in geography	Level of social-physical integration	Focus**
Behaviour and society – geography	Cultural Geography	RUG	Active positioning in human geography, focused on place, culture and identity.	As context, centring around cultural/physical landscapes.	Minor integration through landscapes.	B
	Economic geography	RUG	Human geography focused on socio-economic development and entrepreneurship.	Absent.	Absent.	S
	Environment and Infrastructure Planning	RUG	Socio-technical planning.	Environmental issues through management perspectives, with limited physical geography.	Present from a socio-technical angle, on environmental and water management	S
	Population Studies	RUG	Focus on population issues (demography - human geography) including migration and population trends.	Absent	Absent.	S
	Real estate studies	RUG	Studying the interface between economic geography, finance and economics. Industry orientation.	Absent.	Absent.	S
	Society, sustainability and planning	RUG	Spatial planning from a people-centre perspective. Sustainability from the angle of self-organization.	Absent.	Through mentioning of UN SDGs including clean environments.	S

Spatial Sciences	RUG	Socio-spatial perspective with specialization options.	Option to specialize in environmental planning.	Absent.	B
Human Geography	RU	Broad range, including economic geography, cultural geography, urban geography and tourism geography.	Absent.	Absent.	S
Spatial planning	RU	Spatial and institutional planning from the perspective of mobility, urban development and policymaking.	Included with a minor focus on water/climate issues in urban contexts in one specialization.	Included in one specialization on impacts of climate change on urban environments.	S
Environmental and Energy Management	TU	Social components through management perspectives, less from social/human geography perspectives.	Mostly focused on technical spatial intervention.	Sustainability from a socio-technical angle with human geography as context	S
Human Geography	UU	Focus on urban and economic geography.	Absent.	Absent.	S
Spatial planning	UU	Spatial planning from an urban development perspective.	Absent.	Sustainability from a urban development perspective comes closest.	S
Urban and Economic Geography	UU	Focus on urban and economic geography with a focus on global inequality.	Absent.	Absent.	S
Human Geography	UvA	Focus on urban and political geography.	Absent apart from one specialization on governance and planning of the earth system.	One track focusing on climate change governance.	S

	Urban and Regional Planning	UvA	Interdisciplinary social science emphasis (geography/sociology/political sciences).	Mostly descriptive regarding the interface society-ecology.	Approached through describing socio-ecological challenges in urban contexts.	S
	Urban Studies	UvA	Focus on economic, social, cultural and political issues related to urbanization.	Absent.	Absent.	S
	Environment and Resource Management	VU	Focus on governance, policy and resource management, more than on human geography.	Attention to the environmental system, embedded in climate science and environmental studies.	Focus on societal solutions for natural resource depletion and degradation.	B
Nature – earth sciences	Energy and Environmental Sciences	RUG	Only included in one policy-oriented course.	Most of the focus on general natural science and engineering.	Sustainability from the perspective of energy and natural sciences.	S
	Marine Biology	RUG	Absent.	Biology and ecological conservation courses.	Only through a policy component.	S
	Biobased Materials	UM	Absent.	Rooted in material sciences and bio-organic chemistry	The societal use of biobased materials to stress the relevance of the technical focus.	S
	Environmental Sciences	OU	Environmental degradation issues as a backdrop for the program's natural science perspectives.	Natural sciences to look at environmental degradation. Basic lithographic etc. perspectives.	Natural sciences complemented with social views to discuss sustainability.	S

Earth Sciences	UU	Used as a backdrop to present the core focus on earth surface processes.	Earth surface processes, sedimentary systems and climate.	Social implications of physical geographical issues as context.	B
Geographical Information Management and Applications	UU	Absent	Through technical courses on data management and analysis.	Technical solutions to solve environmental and social issues.	S
Marine Sciences	UU	The social component is included with a focus on global policy and law.	A focus on coast morphology, oceanography, sedimentation and ocean-atmosphere relations.	Reference to the impact of humans on marine systems.	B
Sustainable Development	UU	Visible through an international development specialization. Otherwise mostly public policy oriented.	Energy, material or ecology-oriented. Some climate change modules.	General multi-disciplinary positioning between social and natural sciences.	B
Earth Sciences	UvA	A minor management component is included for the social side.	Physical geography in interaction with ecology, hydrology and environmental chemistry.	Reference to integrated human-physical systems as context for natural sciences.	B
Earth Sciences	VU	Only included in one specialization with reference to governance and environmental economics.	Physical geography, with tracks on geology, climate change and environmental policy.	Humans as impacting the environment.	B

	Hydrology	VU	Hydrology applied to practical societal questions and governance situations.	Core of the program, focusing on hydrological processes, spatial analysis and climate modelling.	Positioning of hydrological questions in societal context like drink water quality.	B
Agriculture and natural environment – landscape	Aquaculture and Marine Resource Management	WUR	There is a governance specialization which deals with public policy and international law.	The natural science component centres around biology and ecology.	Focus on biodiversity and ecosystem functions.	S
	Climate Studies	WUR	Some tracks focus more on the social side of climate change from a management perspective.	Soil and atmospheric chemistry are central. Some overlaps in topics with physical geography.	Climate change with some inclusion of socio-economic and planning aspects.	S
	Earth and Environment	WUR	Absent.	Overlap with topics studied in physical geography, and biology, meteorology, chemistry.	One specialization stresses the societal relevance of environmental issues.	S
	Forest and Nature Conservation	WUR	Several geography-related perspectives in one track, including communities, conservation and development.	The natural science component centres around biology and ecology.	Through natural resource management, including social contexts and social use.	S
	International Land- and Water Management	WUR	Some tracks cover human geography-related topics including gender and political ecology.	Physical geography is implicitly included through foci on land degradation and erosion processes.	Positioning at the interface of physical, technical, socio-economic dimensions.	S

Landscape Architecture and Planning	WUR	Human geography perspectives on landscape are included, incl. spatial planning of landscapes.	Only indirectly in some electives dealing with climate change.	Technical planning for future landscapes considering different stakeholders.	S
Urban Environmental Management	WUR	Social science perspectives around spatial planning and sustainability governance, in socio-spatial contexts.	Only indirectly in some tracks through a focus on environmental modelling.	Focus on urbanization regarding environmental impacts.	S
* RUG: University of Groningen; RU: University of Nijmegen; UU: Utrecht University; UvA: University of Amsterdam; VU: Vrije Universiteit Amsterdam; OU: Open University; WUR: Wageningen University; TU: Twente University; UM: Maastricht University. ** B = broadening, S = specialized.					

ABSTRACTS

In this paper, we deconstruct how geography is organized as an academic study in the Netherlands. We consider how human and physical foci in geography are included in undergraduate and graduate curricula. As a country with a long academic history and renowned geography programmes, the minimal integration between human and physical geography that we identified is remarkable. We reflect on one high-profile societal debate to illustrate the limitations of the current way of conceptualizing geography as a degree programme: the case of human-induced earthquakes in the Dutch province of Groningen due to gas extraction. We argue that countries with academic geography education similar to the Netherlands stand to gain from embracing the integrative aspects to the field of geography. This is particularly the case when considering processes of global change that rapidly and, arguably, increasingly influence socio-spatial inequalities and livelihoods from global to local levels.

Deze paper bekijkt hoe geografie is georganiseerd als een academische studie in Nederland op Bachelor- en Masterniveau. De analyse laat zien dat de scheiding tussen sociale en fysieke geografie systemisch ingebed is in het Nederlands universitair onderwijs; een opvallende observatie rekening houdend met de lange academische geschiedenis en internationale reputatie van Nederlandse universiteiten, ook wat betreft geografie. We reflecteren op het maatschappelijk debat rond aardbevingen in Groningen als gevolg van gasextractie om de beperkingen van deze onderwijsfocus te illustreren. In conclusie stellen we dat landen met een vergelijkbare academische onderwijsbenadering rond geografie baat hebben bij het omarmen van geïntegreerde sociaal-fysieke elementen die de geografiediscipline kenmerken. Een dergelijke benadering is bijzonder relevant in een globaliserende wereld waarin geïntegreerde natuurlijke en maatschappelijke processen aan de basis liggen van sociaalruimtelijke ongelijkheid.

INDEX

Trefwoorden academisch onderwijs, duurzaamheid, geografieonderwijs, interdisciplinariteit, sociale en milieuproblematiek, Nederland

Keywords: academic education, geography education, interdisciplinarity, societal and environmental problems, sustainability? Netherlands

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