Inaugural Lecture

Impressions on conducting and reporting interdisciplinary and transdisciplinary environmental research in South Africa – a historian's perspective

by

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ABSTRACT

Never in my wildest dreams did I ever think that I would get the opportunity in my academic lifetime to combine, into one inaugural lecture, my regional history research experience in a wide variety of disciplinary fields, and also marry it with my love for History in the field of History teaching methodology and its future dynamics! It was exciting, but at the same time a very complex and serious journey into the mapping and rethinking process regarding the positioning of History in the future. The intention is to stir myself and colleagues out of their possible existing comfort zones, to think anew, to allow us the freedom of thinking and debating more vociferously on how historians think about environmental history from the perspectives of interdisciplinary (ID) and transdisciplinary (TD) research approaches. The main questions are perhaps whether History as a discipline could and should participate and be involved in and contribute to ID and TD research opportunities.

Although some South African historians have focussed intensively on researching and discussing the trends in the environmental history of South Africa in the past decades, no methodology and historical perspective have been suggested yet to to participate in ID research cooperations and even the wide spectrum of research on environmental history per se.[1] *Recently more ID and TD research contributions by historians in environmental history have been noticeably reflected. Some historians appear not to be in favour of, nor familiar with, these kinds of research approaches, especially the greyness that TD can sometimes reflect in terms of research quality, source validity, methodology and publication value.*

In many ways my involvement in environmental history also commenced when I did historical research, in particularly in the former Carletonville (presently Merafong) area for more than 20 years. In a recent revisiting of the area a renewed point of departure in research was made by focussing on environmental crisis history in the former Far West Rand and West Rand areas (eg Mogale City) with water issues as one of the biggest concerns. The experience obtained from this ongoing research could be of value by serving as an example of how to structure a research methodology in environmental history, especially in histories dealing with environmental crises. Although it is true that every local area or region possesses its own historiography – and its own environmental historical historiography, for that matter – the methodology, sources, pitfalls/drawbacks in doing environmental history research in labelled environmental crisis areas differ only marginally.

The lecture starts with a concise conceptual view on what disciplinarity and especially ID and TD entail. This discussion then continues to provide glimpses on broader international trends and thoughts regarding ID and TD research. Trends closer to home are also touched on with some preliminary notes on a quite contemporary historiography of dealing with TD research. A "Triangular Model" is proposed to historians dealing with ID and TD research. A concise case study is presented merely to serve as example.

Some suggestions to consider when post graduate students enter ID or TD training at the Higher Education and Training (HET) level are also made, seeing that TD research currently is mainly steered from the School of Basic Sciences at the North-West University's Vaal Triangle Campus.

The hope is that this discussion in both general and specific terms will stimulate not only debate within history circles, but will also particularly serve as a point of departure for discussions in positioning History and historians in ID and TD environmental history research. A number of suggestions for innovative and sustainable tertiary training in especially the Human and Social Sciences are offered in the "way forward" section of which HET institutions could also take cognisance of.

SAMEVATTING

Ek het nooit in my wildste drome kon dink dat ek in my akademiese leeftyd die geleentheid sou kry om my ervaring in streeksgeskiedenisnavorsing oor 'n wye spektrum van dissiplines met my liefde vir Geskiedenis op die gebied van die Geskiedenisonderrigmetodologie, en die toekomstige dinamika daarvan, in een intreerede sou moes kombineer nie! Dit was opwindend maar terselfdertyd 'n baie komplekse en gewigtige pad om Geskiedenis in die toekoms te posisioneer. Die voorneme is om myself en my kollegas uit hul gemaksones te skud, om van nuuts af te dink, om ons die vryheid te verleen om hardop te dink en te debatteer oor hoe historici oor omgewingsgeskiedenis dink, gesien uit die oogpunte van interdissiplinêre (ID) en transdissiplinêre (TD) navorsingsbenaderings. Die belangrikste vrae is dalk of Geskiedenis as 'n dissipline sou kon en behoort deel te neem aan, betrokke te wees by en by te dra tot ID- en TD-navorsingsgeleenthede.

Hoewel etlike Suid-Afrikaanse historici in die afgelope dekades intens gefokus het op navorsinging en die bespreking van die tendense in die omgewingsgeskiedenis van Suid-Afrika, is feitlik geen metodologie nog voorgestel om navorsing oor omgewingsgeskiedenis per se te doen nie.[2] Onlangs is opmerklik meer ID- en TD-navorsingsbydraes deur historici in omgewingsgeskiedenis gepubliseer. Sommige historici skyn nie ten gunste te wees van, of bekend te wees met, hierdie soort navorsingsbenaderings nie, veral die grysheid wat TD soms kan weerspieël in terme van navorsingsgehalte, brongeldigheid, metodologie en publikasiewaarde.

Op verskeie wyses het my betrokkenheid in omgewingsgeskiedenis meer as 20 jaar gelede begin met streekshistoriese navorsing in veral die gebied wat voorheen as Carletonville bekend gestaan het (tans Merafong). In my onlangse onderneming van 'n hernieude navorsingsfokus in die gebied is spesifiek begin konsentreer op die omgewingsgeskiedenis van die voorheen Verre Wesrand-streek (met water-aangeleenthede as een van die grootse kwellinge). Die ideaal is dat die ervaring wat verkry word met hierdie navorsing (steeds lopende) as voorbeeld sal kan dien van hoe om 'n navorsingsmetodologie in omgewingsgeskiedenis te struktureer, veral in geskiedenisse wat oor omgewingskrisisse handel. Hoewel dit waar is dat elke plaaslike gebied of streek oor sy eie historiografie – asook sy eie omgewingshistoriese historiografie – beskik, daar slegs geringe verskille is in die metodologie, bronne, slaggate/nadele in omgewingsgeskiedenisnavorsing in omgewingskrisisgebiede. 'n Bondige konseptuele blik word gewerp op dissiplinariteit en wat veral ID en TD behels. In hierdie bespreking word breër internasionale tendense en denke oor ID- en TD-navorsing oorsigtelik beskou. Tendense in ID en TD navorsing plaaslik word ook aangeraak met 'n paar aanmerkings oor 'n baie aktuele maar bondige historiografie oor die sigbaarheid van TD-navorsing. 'n 'Driehoekige Model' ten opsigte van ID en TD navorsingsinisiatiewe deur historici word voorgestel. 'n Bondige gevallestudie word ook bloot as as voorbeeld aangebied.

Etlike voorstelle word vervolgens gemaak vir die opleiding van nagraadse studente wat tot ID- of TD-opleiding op HOO-vlak toetree, aangesien TD-gerigte navorsing tans hoofsaaklik bevorder word vanuit die Skool vir Basiese Wetenskappe (Vaaldriehoekkampus) van die Noordwes-Universiteit .

Hopelik sal hierdie bespreking in beide algemene en spesifieke terme nie alleen debat binne geskiedeniskringe stimuleer nie, maar ook in die besonder as vertrekpunt dien vir besprekings oor die posisionering van Geskiedenis en historici in ID- en TD-omgewingsgeskiedenisnavorsing. 'n Aantal voorstelle vir innoverende en volhoubare tersiêre opleiding in veral die Sosiale en Menswetenskappe word ten slotte gemaak waarvan HOO-inrigtings kan kennis neem.

1. INTRODUCTION

In the last two decades of the 20th Century, African environmental issues as perceived from within an international framework[3] alerted historians of Africa to fresh subjects of investigation: issues relating to the exploitation or conservation of natural resources and the effects of climate and specific geographies. Environmental research trends also promoted thinking about sources and other forms of information within researching the histories of environmental crises. For example, although affection for historical research of the local environment in France was not on the priority list by the early eighties, local environmental research in Great Britain flourished and the political history of conservation in the United States became a cornerstone. In 1983, Worster pointed out that the destruction of ecosystem cultures by marketplace ideas and institutions has been continuing for roughly four hundred years, but he also mentioned that environmental historians of these three countries should work together to "achieve a cosmopolitan synthesis of method and substance, one that can help redirect the larger discipline toward a post nationalist history". Worster continues, "The outcome of that research agenda would be, I believe, a revival of the local and regional historical inquiry along with an awakened global imagination."[4] The destruction and deterioration of the planet since early days has to do with growing environmental crises.

In South Africa, global environmental trends awakened the South African community to do research from the early seventies, especially through the input of the Council for Scientific and Industrial Research (CSIR). Other interdisciplinary co-operative environmental research inputs were also made with funds from government departments.[5] History as discipline appears to have seldom formed a constructive part in research inputs of disciplines in the environmental sciences.[6]

So is collaborative and integrative research in South Africa among academic researchers in the Human and Social Sciences a familiar face, though still not extraordinarily utilised. In fact, the past thirty years saw greater co-operation between the Human Sciences and the Natural Sciences in the country. Academics in the majority of subject groups of the Human and Social Sciences appear to remain in existing comfort zones and therefore prefer to mainly drive research performances on a disciplinary scale. Academics in the Natural Sciences follow the opposite route within the Natural Sciences research methodology. Therefore some Historians and academics from other disciplines may find it difficult to explore and conform within expansive integrative, multidisciplinary, interdisciplinary (ID) and transdisciplinary (TD) fields of research. International research scientists were exposed to the concept of transdisciplinarity in already the 1970's.[7] Abroad, recent trends in ID and TD research cooperations appear to be pioneering initiatives from the Natural Sciences. Both are thriving fields for debating themes of mutual concern to all disciplines, and even so from all available methodological and theoretical perspectives. It simultaneously also provokes other

forms of debates, concerns and questions.[8] These are broadly discussed further on in the lecture. In essence it especially is the HET structuring of ID and TD research and training, with the support of academic funding institutions, that should pave the way for maturing faculties as well as subject disciplines and their researchers into modes 2 and 3 levels of research.[9]

In the discussion to follow, a basic conceptual understanding regarding ID and TD is offered, followed by a view on the visibility of both approaches to research in an international and national context. History's role and research in especially environmental history, is valued. A triangular research model is suggested for ID and TD project research steered by historians in environmental history. A roughly drafted framework that suggests ID and TD research approaches from pre- to postgraduate level within the Human and Social Sciences as a point of departure, is also proposed. By refining such a structure to compliment ID and TD training and research in, for example, environmental aspects with the focus on crises, humans and human sustainability, History and other disciplines in the Human and Social Sciences will be able to add value to training and current community needs. Lastly the intention with this discussion is to also stimulate future debate on ID and TD research regarding possibilities in contributing to theory and method between historians and other researchers in South Africa. Some thorough thinking along these pathways of research may contribute to international trends and acceptable research methodology formats in future.

2. A CONCEPTUAL INTERPLAY

In publications a variety of discussions on the key concepts of this paper, and offspring from these concepts, exists as part of an academic development that appears to have developed from the 20th century. Tress *et al.*[10] are of opinion that articles and discussions in which these concepts are used seldom provide a clear understanding of these and related research concepts.[11] To be on the same footing with regards to the conceptual understanding of *Disciplinary*, *Interdisciplinary*, *Multidisciplinary* and *Transdisciplinary*, a concise definition of each is provided with the emphasis on interdisciplinary(ID) and transdisciplinary (TD):

Disciplinary

In academic circles it is known that all disciplines accommodate an own set of research tools, methods, procedures, concepts and theories which are organised into a certain world view as organised from a framework of beliefs as well as criteria for truth and validity. This makes each discipline fixed, governable, institutionalised conventions. Historical time allows for disciplines to be shaped by external factors and conditions as well as internal intellectual demands.

Disciplinarity from a wider angle

When referring to disciplinarity in research, some regard it as the product of the historical development of science. A debate on the methodological features of disciplinarity still has to reach the second decade of existence among academics. The names of Mitteltrass;[12] Gibbons *et al.*; Klein[13] and Moran[14] may be distinguished as part of the pioneering academics in the field of disciplinarity.[15] Disciplinary research in which communities are involved tends to be more dynamic and flexible because of differences in language, types of knowledge, institutions and fields of research. Though some disciplinary and community boundaries are more difficult to cross than others, disciplinary co-operation occurs all over the globe because of a specific need. Tress *et al.*[16] rightly remark that research boundaries between sub-disciplines are sometimes more difficult to cross than the research boundaries with unrelated[17] disciplines.

Multidisciplinarity

A wide variety of interpretations of this concept exists among users. It is mainly suggested that researchers share a common goal but do not necessarily collaborate; nor do they try to create integrative knowledge and theory. They simply interact in a very loose form of research co-operation. From theoretical discussions evident from literature, it is noticeable that the discipline History features prominently in several of the research projects mentioned. Another aspect that needs consideration is that the nature of historical research is such that History as a discipline can enter into multidisciplinary discourses in research themes undertaken years ago (for example in the Natural and the Human Sciences, etc.) without integrating with these disciplines. Historical writing can imply that research themes conducted years ago by other disciplines can be utilised and reinterpreted from a Human and Social Science perspective to find its way in a community friendly format, and perhaps include oral memories and current impressions.[18]

Interdisciplinarity

In environmental research the concept of *interdisciplinary* can be defined as the involvement of several unrelated academic disciplines. The research theme and need force all to cross subject related boundaries. So a 'new' set of knowledge and theory is created to achieve a common research goal that cannot be broken down to its disciplinary ingredients as it would not have emerged through either disciplinary or multidisciplinary efforts. Tress *et al.* continues,[19]

> *The greatest challenge of integration is to bring different epistemologies together. This requires researchers to become immersed in one another's knowledge cultures, to understand the fundamental differences in their basic theories and axioms and contribute to new knowledge and theory.*

In interdisciplinary environmental research all disciplines must therefore adapt if they want to achieve a common goal. It may very well happen that in co-operation across disciplinary

boundaries the need develops to transform ideas on a unique methodological framework into a newly developed discipline. The emergence of new disciplines or sub-disciplines is often manifested in the appearance of a new specialised journal, a research programme, a research unit/institute/niche or the appointment of a research chair. Research trends in South Africa appear to follow the same route.[20]

Transdisciplinarity

Environmental research projects that involve academic researchers from unrelated disciplines as well as non-academic participants[21] (for example, user groups, land managers, governmental and non-governmental organisations, and the general public), as well as professional researchers operating as consultants outside academic-focused institutions, are defined as being transdisciplinary. In transdisciplinary research, academic research knowledge is 'married' to firsthand experience and knowledge of the research focus of study on the environment/an environmental theme such as industrial water pollution in area X or Y. Two key justifications for undertaking this kind of participatory research are:[22]

- that it is more relevant to society than disciplinary efforts; and
- that it provides for a more holistic perspective on problem solving of an environmental aspect, as identified to be an issue, or problematic or that requires remediation and/or improvement. [23]

In literature there are numerous examples of 'transdisciplinary' research that should actually be labelled 'participatory' research because (unlike the prime focus in transdisciplinary research) in the latter the intention and focus are not to integrate different knowledge cultures to create new culture and theory but mainly to apply or develop research.[24] Gray conceptualises transdisciplinary collaboration as innovation networks, underscoring the need for network stability, knowledge mobility and innovation appropriateness.[25] The philosopher Mittelstrass[26] has, in earlier years, defined transdisciplinary as being associated with interdisciplinary in the sense that it helps to overcome the splintering of disciplines, whenever these are in danger of losing their historical consciousness:

> *Transdisciplinarity does not mearly leave the individual disciplines as they are, it reinstates the original unity of science, even if only within the context of particular solutions to particular problems. However, this unity is, again, the unity of scientific rationality...*

More than a decade later than Mittelstrass' thinking, physicist B Nicolescu[27] values transdisciplinary research as complementary to disciplinary studies, though it is clearly distinct from disciplinary research. He is of the opinion that transdisciplinary knowledge corresponds to a new type of knowledge because it corresponds with the external world and not only with a discipline or disciplines. Nicolescu also regards transdisciplinarity as being founded on postulates such as that:

- in nature and in man's knowledge of nature, different levels of reality and, correspondingly, different levels of perception exist; and
- the structure of all the levels of reality or perception is a complex structure because all exist at the same time;
- The passage from one level of reality to another is insured by the logic in the middle.

It therefore is Nicolescu's opinion that, once the postulates of transdisciplinarity are formulated, they should have a much wider validity than modern science itself, because they could be applied in the field of education and culture. He continues,[28]

> *The transdisciplinary education, founded on the transdisciplinary methodology, will allow us to establish links between person, facts, images, representations, fields of knowledge and action, to discover the Eros of learning during our entire life and to built being in permanent questioning and permanent integration.*

To conclude the conceptual discussion on the features especially of ID and TD research, the observations by Julie Klein[29] may be said still to apply in a 2010 context:

> *The contexts of interdisciplinary and transdisciplinary research vary greatly, as well as the attendant methodologies and conceptual frameworks... Interdisciplinary and transdisciplinary research performance and evaluation are both generative processes of harvesting, capitalizing and leveraging multiple kinds of expertise... Readiness levels are strengthened by antecedent conditions that are flexible enough to allow multiple pathways of integration and collaboration... Research in the multidisciplinary-interdisciplinary-transdisciplinary environment is not a set of mutually exclusive categories. Research is too complex* [in particular contexts].[30]

3. OUT OF AFRICA: HISTORICAL ROOTS ON CONDUCTING AND REPORTING ID AND TD RESEARCH

General reflections

It is accepted that the use of integrative research concepts evolved in general academic discourses and not in a specific field of study. The use of the concepts *interdisciplinary* (ID and known as a concept since the 1920s) and *transdisciplinary* (TD and used from the early seventies) was mainly interpreted as a counter-reaction against the autonomous and elitist approach visible in Science and higher education. It was in the late sixties that interdisciplinary discussions actually gained momentum as a result of a perceived inability within disciplinary specialisations to solve societal problems. These debates led to the first international conference in 1970 in France, arranged by the Organisation for Economic Cooperation and Development (OECD), on scientific approaches crossing disciplinary boundaries. It was then that new research vocabulary such as multidisciplinarity, interdisciplinarity and transdisciplinarity emerged from the OECD Conference contributions. One of the major critiques expressed during the Conference was the absence of communication between the natural sciences and society in particular. During the OECD Conference it was physician Erich Jantsch who was regarded as influential in setting the discourse of the debate. Years later, in the 1990s, Gibbons and others reinforced the radical statements of

the OECD Conference of 1970.[31] Within landscape ecology research the ID and TD concepts received attention in 1978 when Naveh[32] introduced landscape ecology as the interdisciplinary scientific basis for environmental education. Ten years later researchers still debated the need for specific integrating concepts and methods in "true interdisciplinary" research. In the same decade ID and TD research was stimulated further when the future sustainability of the earth, with its various local and continental environments in which man operates, became the focus of urgency in conferences and in government circles.[33]

Within the projects of landscape studies in the late nineties to early 21st century, for example, a wide range of thematic fields was covered which mostly dealt with combined aspects of nature and culture or human use of land. Disciplines within the Natural and the Social Sciences and Humanities became involved. Themes such as the following were researched: [34]

- Land use history;
- Plant diversity;
- Conservation and management of pastoral landscapes;
- Human impact on landscapes;
- Biodiversity on arable and fallow lands;
- Planning and integrated management of the countryside;
- Restoration and planning of local landscapes;
- Holistic management of national parks; and
- Values of landscape elements.

Another valuable field in nurturing ID and TD research is the conducting of impact assessments, whether they are environmental impact assessments, for example, in water projects (mostly steered from the Natural Sciences) and/or social impact assessments (steered by/among the Environmental and Human Sciences). The introduction of impact assessments (IAs) in the USA dates back to the 1970s, and this country is also regarded as the pioneers of IAs.[35] South Africa only formalised environmental impact assessments from the late nineties.[36]

A handful of international scientific journals that emphasises ID and/or TD related research, were founded from especially the 1960s:[37]

Journals
Interdisciplinary Science Reviews
China Review (An interdisciplinary Journal on Greater China)
Human Nature – An Interdisciplinary Biosocial Perspective
Inquiry – An Interdisciplinary Journal of Philosophy
Animation – An Interdisciplinary Journal
Biography – An Interdisciplinary Quarterly
Family relations: interdisciplinary journal of applied family studies
Global social policy: an interdisciplinary journal of public policy and social development

Information – An International Interdisciplinary Journal
Journal of Interdisciplinary Economics
Mosaica Journal for the Interdisciplinary Study of Literature
Organization: the interdisciplinary journal of organization, theory and society
Skull Base – an Interdisciplinary Approach
Text and talk: An interdisciplinary journal of language, discourse & communication studies
Journal of Interdisciplinary History

It is more than possible that disciplinary focussed journals accommodated discussions with an ID and/or TD focus if it fitted the Journal's policy and if it could survive the peer review process searching for quality and also acceptable disciplinary-focussed research in articles.[38] On the other hand it was realised by scientists[39] that a "unity in science" became more of a reality from the last decades of the 20th Century in which:

> *Knowledge becomes more and more anonymous, and science become harder to survey, as the scientist becomes more and more modest in his or hers selfchosen specialist niche. Thus the architecture of the whole, in which the sciences and scientists can find their places, becomes increasingly unclear.*

This unclarified academic space is not provided for within foci of disciplinary journals. Therefore new thinking and research trends in the past thirty years has urged for a revisiting of the research methodology of disciplines to be able to accommodate one another in ID and TD research[40] as well as in the publication of "unity in science" efforts. To be able to do so, a few basic points of departure in the way of thinking about research within these research frameworks are suggested:[41]

- Accept that research methodologies of disciplines vary because of their focus, the needs and disciplinary requirements in general;
- No discipline involved can embark on an ultimate research method that provides for the most representative and most reliable research results required to understand the research context, the research content and the broader impacts on and by society;
- The urgency and will to work together on a research theme whose results may be to the advantage of sustainability of man and environment in local or international societies should outweigh the fundamental differences among disciplines; and
- Progressive and innovative thinking (theoretically and in the epistemological practice of conducting research) should allow for justification in higher education structures to eventually accommodate degrees in the ID and TD fields of research.

By 2005 the need for developing integrated knowledge and theory from ID and TD research was still due, [42] though Klein and others in 2001 has produced a quite extensive publication on a variety of TD aspects researchers should take note of.[43] In 2008 Klein[44] suggested, in an informative article on ID and TD research issues, some evaluation principles and key insights as a framework for conducting research in these fields. She also outlined the various outcomes that may be obtained from research in a variety of co-operative disciplinary contexts:[45]

- A feedback to multiple fields or disciplines;
- Expanded expertise;
- Expanded vocabularies;
- Expanded tool sets;

- The ability to work in more than one discipline;
- A greater proclivity toward interdisciplinary and Transdisciplinary collaboration;
- A widened sphere of professional reading;
- Forming of new formal affiliations; and
- The opportunity of co-mentoring post graduate students.

Klein[46] remarks that the power of a generative approach in transdisciplinary research lies in its flexibility within a catalogue of criteria that might prevail, as all criteria may not apply at all phases. Among others they are: scientific quality or integration; timing and number of evaluations and who [probably refers to a discipline rather than a person] to assign to perform the evaluation as well as the weighting of criteria [probably refers to a discipline rather than a person], are left open too. Collaboration is a key word in ID and TD research as available, up to date in many countries and continents.[47] Also in several models that accommodate a transparent, collaborative feedback relationship.[48]

The how of ID and TD research[49] has internationally paved the way for asking valid questions in education circles, such as how students perceive this kind of exposure to research and their training. In 2008 Tress *et al.* stated about students in landscape research:[50]

> *The growing demand for integrative interdisciplinary or transdisciplinary) approaches in the field of environmental and landscape change has increased the number of PhD students working in this area. Yet, the motivations to join integrative projects and the challenges for PhD students have so far not been investigated. We collected data by a questionnaire survey of 104 PhD students attending five PhD Master Classes held from 2003 to 2006. A manual content analysis was used to analyse the free-text answers. The results revealed that students lack a differentiated understanding of integrative approaches. The main motivations to join integrative projects were the dissertation subject, the practical relevance of the project, the intellectual stimulation of working with different disciplines, and the belief that integrative research is more innovative. Expectations in terms of integration were high. Core challenges for integration included intellectual and external challenges such as lack of knowledge of other disciplines, knowledge transfer, reaching depth, supervision, lack of exchange with other students and time demands. To improve the situation for PhD students, we suggest improving knowledge on integrative approaches, balancing practical applicability with theoretical advancement, providing formal introductions to other fields of research, and enhancing institutional support for integrative PhD projects.*

As part of the concluding remarks, Tress *et al.* remark, "PhD students want to integrate different fields of knowledge, but are not sure how to do this". The role of universities to improve ID values was recently highlighted.[51] Among others, KD Sherren comments,[52]

> *University management can contribute by: establishing a clear academic identity for the university beyond 'excellence', and supporting firm foundations for students based on that particular vision; taking a proactive view of course review and development and facilitating experimentation in those settings; intentionally fostering interdisciplinary units differently to disciplinary ones; and, establishing and recognising equivalence across a range of successful academic career archetypes.*

Sherren's view is that sustainability is more likely to emerge from a healthy and independent tertiary sector than from one operating as an overt policy instrument.[53]

History and ID/TD research abroad

It is said that neither *interdisciplinarity* nor *theory* is new to historians in the USA. In the early 20th century, the historian HE Barnes remarked, "The direct and indispensable relationship of History to the Social Studies is obvious..."[54] This obvious relationship always got in the way in debates and discussions on History's *role* and *value* in science and communities.[55] In this regard the French Annales School's contribution to a methodological framework for Social History should also be acknowledged.[56] Decades later Toebes, in a PhD study on History as a discipline, suggested that a disciplinary co-operative approach among History and Social Science disciplines should be considered more constructively within disciplinary curricula by academia.[57] Because all disciplines are porous to some degree[58] many of the ideas that establish or accelerate new disciplinary agendas usually come from the outside. According to the USA Committee on Graduate Education in the USA, History, more than most disciplines, openly welcomes ideas and methods regardless of their origin. As examples the voraciousness of the Annales School, which regarded everything human and nonhuman as within the scope of the historian, is mentioned.

In the early part of the 20th century, Geography had a supportive impact on historical work in the United States. Thus Marxism was widely influential in the interwar years (1918-1939). Furthermore, many historians embraced the social sciences (especially Sociology) from the mid-20th century. Similarly, Public History emerged from the 1970s. Critical cultural theories have also inspired interest among historians since the last decade of the 20th century.[59] A co-operation with disciplines in the Human and Social Sciences was extended to non-related disciplines (especially in the Natural Sciences) from the 1970s.[60] In multiple publications from various disciplines, reference is made to environmental crisis debates as first- and second-wave ecocriticism, with revisionists at the forefront of having largely absorbed the sociocentric perspective related to a governmental practice of ecological problems such as health, sanitation, birth-rate, race, longevity, etc.[61] From the 1970s[62] History's focused research connections with the environment also included a study of man and nature and their past relationship from other angles than at any other time before. Roderick Nash[63] is regarded as the pioneer that provided environmental history with its name and justified its teaching by the inclusion of environmental history aspects in the history syllabus. Other pioneering environmental historians, such as Ladurie in his research on climate history, even tried to argue that there could be a focus on environmental history "without the people".[64] However, most of these thoughts and teaching probably was originally done in a disciplinary context with little ID and TD project associations.

One of the earliest History courses on ID and theory in the USA was launched at Princeton in 1965 by Lawrence Stone. Among others, the additional goal was to introduce students to relevant (or potentially relevant) work in other disciplines. In this the Social Sciences still featured

prominently.[65] During these times the *Journal of Interdisciplinary History* was founded in 1969 and still exists in 2010. It claims to cover themes in the Social Sciences, Arts and Humanities and current Interdisciplinary contents in the Arts and Humanities. In more specific terms the *Journal*'s ID perspective stretches as far as social history; demographic history; psychohistory; political history; family history; economic history; cultural history and technological history[66] with no clear focus whether environmental history and regional or local history are acceptable within its ID vision. Another focus with a strong ID focus in History is world and global history. Two journals were founded to accommodate this branch of History.[67]

By 2007 the interdisciplinary reach at the University of Princeton was extended with an emphasis on Anthropology, as well as Literary and Visual Culture Studies. The Committee on Graduate Education's general impression was that historians in the USA are acutely aware of major changes in the intellectual agenda of the discipline. With regards to interdisciplinarity the following informative remarks were made by the Committee:

> *There is always an escalation of expectations with interdisciplinary work.... The next generation is expected to know the other discipline from the inside, not as a mere visitor. Students need and deserve the level of interdisciplinary preparation their projects require, and graduate programs should have the flexibility to enable their students to acquire that knowledge. Indeed, as a uniquely open discipline, history is well positioned for the intellectual border-crossing that many expect will characterize the best scholarship of the future.*

It is within so-called area studies that crossing disciplinary borders and an examination of transnational aspects within regional studies that opportunities for intellectual collaboration became prominent. The quest for proper training to accommodate new research trends is repeatedly exchanged:[68]

> *As historians become increasingly spatial in their analysis, area studies theorists and programs may be helpful partners, while history departments can offer area studies programs, many of which have historical foundations, historical training for their students. And, like history, many area studies programs are moving toward the humanistic disciplines.*

Though historians abroad appears to be involved in especially ID research and training opportunities, it was not possible to trace ID or TD initiatives in non-related and related disciplinary research contexts, which evolved from from a history angle.

4. ASPECTS OF ID AND TD RESEARCH IN SOUTH AFRICA

It appears that interdisciplinary research co-operations in South Africa within the Humanities and Social Sciences in the past decades can be traced through intervals of time up to 2009.[69] In the Natural and in Agricultural Sciences an ID co-operation is more common. Certainly the numerous educational changes since the mid-nineties supported a debate on the status and value of ID and TD research in the Humanities and in the Social Sciences.[70]

In 1997 the Centre for Science Development (CSD) conducted an audit on Social Science research methodology training in South Africa at universities and universities of technology. The audit covered approximately 15-20 disciplines categorised as part of the Humanities and Social Sciences, among them being History. A key objective of the audit was to promote an adjustment in the Social Science tertiary research methodology to involve more interdisciplinary (and probably more interdisciplinary co-operation among the Social and Human Sciences) and inter-institutional co-operation. If done so, the arguments by the authors of the report were that it would allow for a more effective use of resources and that a physical inter-institutional collaboration also facilitates the sharing of best practice in research methodology teaching. From this audit another valuable comment was made in favour of ID research, namely that "the whole area of interdisciplinary training is an important focus for closer attention to also overcome unnecessarily narrow disciplinary boundaries in line with international trends in the Social Sciences". The authors continue,[71]

> *Discipline-specific skills in many areas have only a short life and what will be needed even in the medium term cannot be predicted with any great precision.*

Within this justification for interdisciplinary research ventures, the TD focus was also raised as a key element of a "knowledge society" [*sic*] with the intention of solving problems. Though covered in the audit, no in-depth questions on this form of research were raised. Some general recommendations reflecting both forms of research emerged from the CSD audit, namely that the CSD:[72]

- should consider facilitating the development of a generic research methodology module at post graduate level;
- involve other relevant stakeholders (including, for example, students, employers and NGOs) in developing its programmes in research methodology;
- should recognise the value of inter-institutional exchanges in promoting the development of a vibrant research culture;
- should recognise the growing importance of multi-disciplinary research, and to continue to develop and expand programmes which promote such research and address the accompanying organisational and philosophical challenges.

A last recommendation was that the CSD should revisit the audit recommendations in five years; it is uncertain if this ever happened.

The audit findings indicated that community groups seldom consulted some of the Human and Social Sciences disciplines, among them, History. Also it was found that History was consulted the second least by students from other departments at 20%.[73] It was positively outlined in the report that varying degrees of integration are possible but that: "multi- and transdisciplinary research are best viewed on the continuum".[74] Lastly, the authors of the CSD report interestingly remarked that

"In the traditional 'single discipline' model, quality is assessed through a variety of peer review mechanisms within each individual discipline; the drive towards transdisciplinary research challenges this". The Higher Education White Paper of 1997 also endorses transdisciplinary research:[75]

> *The accountability processes that flow from the changing nature of the research enterprise are much wider than those associated with traditional research in the higher education system. The outcomes of research are not only measured by traditional tools such as peer reviews, but also by a broader range of indicators such as national development needs, industrial innovation and community development.*

ID research in South Africa is supported and funded through many channels and tertiary training pathways. A typical example of current interdisciplinary research[76] is the multi-year, interdisciplinary research platform (IRIP) at the CSIR to investigate models of sustainable and integrated municipal service delivery.

Another ID research success story at HET level in South Africa is that of the North-West University (NWU). Recent changes have partially resulted from the suggestions made by the Department of Education in its published White Paper on Higher Education in 1997. The North-West University followed the path of Focus Areas to integrate research and post graduate education based on existing strengths, aligned with national priorities and with an emphasis on an ID focus. Ironically a 13th Focus Area, named Sustainable Social Development, was approved only in the early 21st century, and years after the other 12. History's research future as a Subject Group continued mainly within this Focus Area. The Faculties, with minor adjustments, were retained and some accommodated members of more than one faculty. [77]

Although the ID research focus of the NWU operates actively and successfully as a so-called Mode 2 university (essentially meaning that the focus is on applied research that builds on Mode 1 research which is basic and fundamental disciplinary research), space for accommodating[78] a TD research focus (as a possible Mode 3 research focus in which ID forms of applied research is also emphasised, but created and supported more with public and broader community inputs). It is within the Social and Human Sciences that Mode 3 research forms part of the research methodology and in which opportunities can also be extended more formally at HET level, accommodated and financially supported to eventually be as viable perhaps as, for example, the Unit for Environmental Studies at the Potchefstroom Campus of the NWU. This ID-focussed Unit is functioning very successfully with external funds. To accommodate the Human and Social Sciences, the institutional authority's focus should, in addition and as part of an institutional focus towards innovation, rather be to support the development of a Unit for Human and Social Sciences based on especially Mode 3 research, but with an equal emphasis on Mode 1 and 2 research obligations. Within the research activities of the Vaal Triangle Campus of the NWU the Niche Area

for Cultural Dynamics of Water (CuDyWat) under the School of Basic Sciences, may perhaps find a better home in a Human and Social Sciences Unit for Environmental Studies to, among others, ensure more research involvement and ID co-operation with related and non-related disciplines, including the Natural Sciences. Although ID research through the natural sciences' structures of dealing with environment encourages a closer co-operation with the Human and Social Sciences, it does not endorse any serious research project co-operation from groups or individuals from communities. Mode 3 research is a greater feature of the Human and Social Sciences and should therefore be accommodated in a research space where disciplines in the Human Sciences could operate from and also reach out to non-related disciplines willing to co-operate in research projects with a dominant Human and Social Sciences focus.

5. HISTORY, HISTORIANS AND ENVIRONMENT-RELATED ID AND TD RESEARCH?: PAST AND PRESENT TRENDS

In 2008, Lance van Sittert of the University of Cape Town wrote an article on traces regarding the changing role of environmental determinism in the invention of 'South African' history, as already noticeable in Eric Walker's South African History after 1910. Roughly 90 years later the formal national history of man's utilisation of the environment, which eventually contributed to crises that affected the histories of class, race and gender, still requires attention,[79] and also requires understanding from ID and TD angles.

An icon of South African history practice, historian FA van Jaarsveld, supported a disciplinary co-operation between History and other disciplines in the 1970s as an addition to the expansive development of History's focus and fields of research.[80] The then emerging field of Local History research in South Africa,[81] for example, has paved the way for history researchers to become more aware of regional social trends that allows for closer ID and TD research opportunities because of the varieties of knowledge and insight required to conduct quality research in local history.

Local history research from the late seventies to early eighties developed alongside the methodological ideas constructed by the History Workshop Group of the University of the Witwatersrand. In essence, the research approach by this Group was to emphasise a history from below, which meant that the role and input and knowledge of communities in certain environments and/or activities should be acknowledged in the scientific research process. In many ways this is what TD research is all about, with some additional thinking and distinctions attached to TD related research (see Figure 1). Historians, archaeologists, educators, political scientists, geographers and sociologists were key professionals to be associated with the academic activities of the Wits History Workshop Group.[82] Views on contemporary TD research methodologies could therefore, to

a lesser or broader extent, certainly be associated with some of the historiographical trends that South African historians (and others internationally) were exposed to for decades.

In environmental history research, the decades long 'TD approach' (only in the seventies labelled as such and further refined for History – See Figure 1) also became readily applicable to environmental history because of inevitable connections with communities, their experiences and wealth of oral history memories. A thematic focus on an environmental crisis can, for example, be public health, nature preservation, smoke reduction, municipal housekeeping, occupational disease, air pollution and water pollution. The many voices, debates and differences in statistical data, together with intellectuals' thinking and debating on environmental ethics, justice, human and legal rights, environmental crime and hydrosolidarity,[83] allow for environmental history research from a broader TD angle (See Figure 1). However, this branch of History was not widely explored by historians, as observed in the late nineties,[84] though Carruthers' impression is that environmental history blossomed at the end of the apartheid era.[85]

The widely acknowledged environmental publication by S Dovers, R Edgecombe & B Guest on South Africa's environmental history in a comparative form was published in 2002.[86] In many ways the dominant focus of all contributions was an exploitation of nature by man from a disciplinary context. Jane Carruthers and William Beinart are also regarded as pioneer historians recording environmental history within an ID context and co-operation.[87] Carruthers has noticed that "there is ...an overall absence of active collaboration between historians and other disciplines" in the Human and Social Sciences which also at least make use of chronology in their research methodology.[88] Environmental historians in a variety of research fields to be connected with an ID research focus in more recent times are Kobus du Pisani,[89] Phia Steyn, Lance van Sittert, Sandra Swart and Johann Tempelhoff.[90] Some also associate more with the Natural Sciences in research projects.[91]

As far as TD-related research in environmental History is concerned, a quality publication that conforms to internationally developed indicators for TD research,[92] and with a personal methodological and theoretical touch of historians, has yet to be produced (the triangular model in Figure 1 serves as my broad criteria of assessment in the absence of a clear methodology and theory by Historians). In some way it also appears as if environmental historians currently (2010) are divided in camps because of their different opinions regarding the focus, value and quality of ID and TD research projects, as well as their outcomes. In for example Carruthers' keynote paper in 2006 at one of the first TD-focussed conferences (organised by Tempelhoff of the NWU) in the Kruger National Park she thematically reflected that transdisciplinary aspects will be covered. However, the outcome of the keynote address mainly remained in exchanging some valuable ID

reflections within a transnational context. Perhaps one can argue that the conceptual understanding of TD and History's involvement at the time yet had to be clearly defined and so the definition was misunderstood as being only interdisciplinary. On the other hand the ignorance of TD as part of the main discussion also sends out vibes of an uncertainty or a non-association with the TD research approach part of the historical methodology. However, Carruthers' plea[93] in the conclusion indeed compliments some of the aspects within the criteria of TD research in environmental history (also see Figure 1):

> *A special plea should be made around the need for greater indigenous knowledge...in southern African environmental history...'scholarly expertise should not subordinate the experiences and knowledge of ordinary people'...understanding the social history of the communities that lived in them is imperative. Active collaboration with other disciplines is also imperative. The environmental and agricultural sciences are obvious partners, but archaeology and explorations into even deeper time with the assistance of climatologists or paleo-anthropologists and the like would add immeasurably to the stature of environmental historians as mediators and bridge-builders between knowledge areas*

From 1999 to 2009 several environmental research efforts, under the banner of a TD-related focus but with definite features of ID-related environmental research by historians at the North-West University, have produced research results in many forms, namely reports to local governments, articles in national and international journals and some relations with non-related disciplines (the natural sciences).[94] Activities and innovation also resulted in the founding of the first volume of *The Journal for Transdisciplinary Research in Southern Africa* whose first edition appeared in December 2005. Two years later the Journal gained accreditation and is currently editorially managed by the Subject Group History (with Tempelhoff as editor) in the Faculty of Arts.[95] Within the short historiographic framework of reference then to transdisciplinary historical research on environments – or research in this field done by, or involving historians - the North-West University (NWU) has apparently pioneered new modes of thinking on TD research. Most prominent among all initiatives by South African historians is JWN Tempelhoff who, in the past years, also enhanced research opportunities in environmental history in water studies through a TD lens, although his thinking does not necessarily feature the TD focus as suggested in Figure 1. The extended focus currently also accommodates ID and TD social impact research needs as 'hot-spot project research' (in Afrikaans, *hedenavorsing*) or research on contemporary needs. In regional forums of the International Water History Association (IWHA) discussions among various experts from several disciplines under an environmental ID and TD banner were, and are still, stimulated.[96]

However, despite these pioneering efforts on ID and TD environmental research in History, definite discussions and structured thinking on the most feasible methodologies still require some extensive debate among historians.

6. IMPRESSIONS ON RESEARCH 'MODELS' FOR CONDUCTING AND REPORTING ID AND TD ENVIRONMENTAL RESEARCH IN SOUTH AFRICA WITH HISTORY AND HISTORIANS AROUND

After having been involved for several years of my academic life with mostly regional history, based particularly on the Skipp Model and some adapted versions of his model over time as life shaped my historical thinking,[97] I am convinced that historians are equipped to efficiently deal with ID and TD research without forgetting and ignoring their valuable historical roots. Regional and/or local history covers a variety themes in which human involvement and human interaction with the environment is accentuated. Many connections with researchers and private research consultants in other disciplines (also exploring a specific environment from a focussed research angle) provided me with new insight on the value of doing research together to expand my thinking, perspectives, knowledge and perceptions (as the latter tends to be around people all the time) about the actual historical process of what happened, how it happened and what happens now. To be able to dissect a research theme into its smallest of micro questions and relics, and to be able to find information and solutions about them (whether they are in an archive, in the fieldwork process or laboratory) should be possible to be anchored together to exchange broader views and offer meaningful solutions if they are required by a broader community.

Historians should not avoid research possibilities that are also ID, but especially TD, inclusive. History's wide research field and knowledge at all levels of community actually allow the discipline to take the lead in research processes of an ID and TD nature within the Human and Social Sciences, as well as among other non-related sciences. In the process nothing is lost; rather gained. If approached wisely and meaningfully, the fundamental qualities of the discipline will remain being the most valuable point of departure in conducting and thinking about research. The historian's willingness to invest in ID and TD research in, for example, environment-related research should be accepted as additional to the heuristic and methodological features of the discipline; call it History in its 'applied' mode in a current context if you wish.[98] I do believe that environmental research projects, in which crises (slow or fast)[99] feature and in which History and historians feature prominently, should always be triangularly approached. One may refer to it as multidisciplinary, but then multidisciplinary research within a totally new meaning and context. As regards History, it may imply the following:

TRIANGULAR RESEARCH MODEL FOR HISTORY IN ID AND TD RESEARCH

PHASES OF RESEARCH

(PHASE 1 research)

DISCIPLINARY (D): [MODE 1 HET RESEARCH]

The basic focus of a project must first be researched from a D context. If sufficient historical information is already available before a research project commences, the interdisciplinary (ID) research process may start immediately. It may then imply that Phase 1 is just partially required in the sense that the available historical data must be compiled to be utilised in Phase 2. To be effective in Phase 2, research in Phase 1 is compulsory and therefore not be ignored.

(PHASE 2 research)

INTERDISCIPLINARY (ID): [MODE 2 HET RESEARCH]

- Identify the research foci/problems if they have not already been identified and requested by the major fund provider/customer/client.
- Identify expertise ID role-players (inter-tertiary/university/private research consultants) that are equipped to address these research foci/problems that apply to their field through specific objectives. Clear objectives may involve more expertise to approach a research problem as part of a bigger problem in question.
- Involve post graduate students (if possible and if necessary) in the ID research focus. The structure of post-graduate involvement, as suggested later in this discussion, should be considered. ID environment-related research by post graduate students should accommodate the research methodology and theoretical thinking of all the disciplines involved, though one may be more prominent than others, depending on the field of research.
- In research with History as major project leader, the research proposals of post graduate students should also feature the presence of the subject group's fundamental methodology and theory. If this is not the scenario regarding the ID-focused research theme then these students ought not be accommodated in the subject group of History and can the project content not claim to be ID research, also complementing History in general.
- Post graduate students may, during the process of project research and training, be exposed to aspects of transdisciplinary research. However, eventually these exposures should be accommodated as part of the process of gathering information as based on the research aims and/or objectives in their research proposal. At no stage an informed community/individual should and could be prominent as promoter/leader in the post graduate researcher's report or a project research report in general. The data obtained from transdisciplinary research only forms part of the report in an applied way.
- External research consultants such as environmental expertise should be utilised more to give research support as co- or supporting promoters/study leaders in the training of post graduate students at Higher Education and Training level. Their academic credentials and expertise sometimes can make them more suitable to assist with guidance than History expertise from HET environments.
- The role of the historian/researcher in ID research and ID related post graduate training regarding the environment, is to ensure that the theory and methodology of History also features meaningfully and expands prominently through ID (and in Phase 3 through TD) exposures. A contribution of this nature can only supports a richer and more extensive research D-related methodology.

(PHASE3 research)

TRANSDISCIPLINARY (TD): [PROPOSED MODE 3 HET RESEARCH]

- In essence the generally accepted TD research approach is quite familiar to historians (for example, in environmental, regional or local history research). A history of communities cannot be properly recorded if it is not involved in or contributes to memories and primary resource material not available elsewhere.
- As far as research in History is concerned *three forms* of TD-related research could apply, namely:
  - Research information that communities/individuals/groups/research consultants/disciplinary knowledge by HET expertise share/exchange with regard to the environment and their experiences regarding the environment. The historian simply utilizes this information according to the historical research methodology and writing process. In a research report that embarks on an aspect of TD research, this form of information application will apply and contributors only be acknowledged in the references section.
  - Research information that communities/individuals/groups/research consultants/disciplinary knowledge by HET expertise share/exchange and continue to help find in a research project as full partners in a research project. Together with the historian(s) these contributors participate in the research and in the writing process of the report based on research criteria that those involved have found consensus on. They thus form part of the authorship of the report.
  - Research information that communities/individuals/groups/research consultants/disciplinary knowledge by HET expertise share/exchange and continue to help find in a research project as full partners in a research project to write scientific articles/to share the podium at conferences/to provide student guidance within a specific focused training environment.

FIGURE 1

AN ENVIRONMENTAL RESEARCH PROJECT WITH HISTORY AS MAJOR RESEARCH LEADER WITH ADDITIONAL ID AND TD OPPORTUNITIES

Undertaking historical research on the environment and an environmental crisis does not imply that the historian's focus should only be a broad analytical history to explain the role of development or process in the environmental crisis. Although this kind of information is important and valuable to expand disciplinary horizons in many ways, other possible and necessary research from ID and TD perspectives also require the attention and consideration of historians. In a research environment of this nature the historian should also be open to the other ways of doing research and to constantly rethink opportunities of shaping existing historical thoughts on an all inclusive 'mixed discipline' way of doing environmental research. Therefore the incorporation and even utilisation of theories and models from the research methodologies of other disciplines in specific ID and TD research projects and contributions should be accepted as a requirement of the time for which the historian is part of and could learn from. Thus, for example, did the South African, L Price, in 2007[100] suggest his views for environmental research from a transdisciplinary explanatory critique research framework. In his methodological approach he remarks:

> *I adopt a qualitative transdisciplinary textual analysis of relevant documents using Fairclough's Critical Discourse Analysis and Bhaskar's Dialectical Critical Realism with some insights taken from Bhaskar's more recent concept Meta-Reality.*

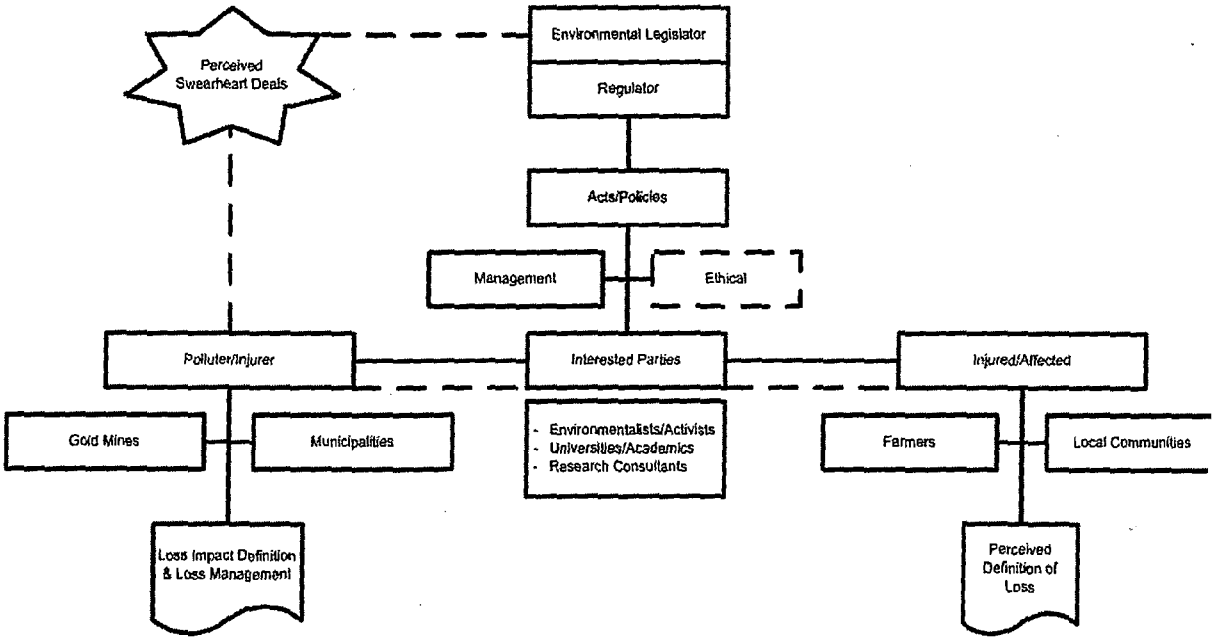
Although the frameworks Price utilised in his methodological approach are not the only ones offered or available in research of this nature, the essence is research, whether it involves one or more disciplines and even communities and should be structured in such way that those involved can function in it with clarity and focus. A research framework can eventually be shaped into a workable model.

Searching for D, ID and TD themes in environmental history dealing with a local crisis

Environmentally related activities and concerns may be identified by structuring key role-players and issues to be dealt with in a local crisis scenario (see an example in Figure 2 below):[101]

FIGURE 2

Environmental Management Relationships in the WFS area pre 1994



The role-player structure in Figure 2 illustrates the concerned stakeholders' focus on water pollution in the Wonderfonteinspruit Catchment, Merafong (formerly Carletonville) as an example. The area is known for its environmental crises involving water pollution, sinkholes, chemical toxicity features, etc.[102] Within a research project, from a historian's perspective, several themes may be researched as 'problem questions'. In each of the themes below the potential exists to construct a variety of research objectives, noticeable from a broader Human and Social Sciences focus, to complement the historical reporting focus within an ID and TD research context:

- The role of the injurer(s) in creating or abusing environmental knowledge [The injurer may vary. In the Wonderfonteinspruit Catchment context, the major polluters/injurers within a direct and/or indirect context are the mines and the government];
- The role of scientific knowledge and scientists/research consultants in correcting/endorsing environmental practices of the day;
- The role of the local authority in environmental practices and creating knowledge;
- Aspects of power play, ethics, environmental injustices/justice, human rights movement and environment, economic choices versus the environment, etc.;
- Determining the application of past environmental ideology and laws in an area and to what extent it is possible to reverse thoughts in new acts after 1994;
- The environmental awareness/experience, and/or laxity and/or ignorance of local/regional citizens regarding an environmental crisis or crises in their own area;

- The role of non-governmental organisations (NGOs) and environmental activists in activating i) environmental remediation processes and ii) enforcing the principle that the polluter pays;[103]
- To take critical account of the thinking and actions behind the past to present environmental remediation/preservation history and process;
- The business community's handling of an/the environmental crisis;
- Past and present effects of, for example, chemical pollution on water resources used by the local agricultural sector and the low-income communities in informal housing areas, etc.;
- A history of the effect of an environmental crisis such as water pollution on the health status of local communities;
- A historical account of local ecohealth destructors;
- A scientific history and present thoughts/actions regarding the/an environment's remediation potential and future;
- The effect of an environmental crisis on communication abilities, roads, the local economy, political rivalry; education; religion, etc.

To the historian dealing mostly with local or regional history, some examples of the themes above will be familiar, the only distinction being that the content is reflected from an environmental crisis perspective that in itself is a rearrangement of knowledge to create new knowledge and insights.

Aspects of conducting and reporting environmental research from an interdisciplinary and transdisciplinary perspective to be considered in the historical research methodology

Much may be learned from scientific experts currently involved in the fields of ID and TD research, regarding efficient conducting and reporting mechanisms from which historians may also benefit.

In integrative-like research across disciplinary and faculty boundaries three components should be discernible, namely the organisational, the methodological and the epistemological.[104] Questions that may evolve from these components, according to Klein,[105] are:

- Is the spectrum of expertise and fields involved too narrow or too broad for the task at hand?
- Have all relevant approaches, tools and (research) partners been identified?
- Is the research structure flexible enough to allow for shifting groupings of individuals and context-related adaptations, deletions and additions?
- Has synthesis unfolded through patterning and testing the relatedness of materials, ideas and methods?
- Have known integrative techniques been utilised, such as the Delphi Method, scenario building, a general systems theory and a computer analysis of stakeholders' perspectives?
- Is there a unifying principle, theory or set of questions that provides coherence, unity or both?

The following may be aspects of an integrative research methodology (as in ID and TD) to be considered in the 'fieldwork process' that complements the possible themes as proposed (see notes on phases in Figure 1 and themes in Figure 2) and in which History may feature just as prominently as any other discipline involved:

- Define the environmental crisis and the potential problem-related research focus;

- Research design (planning, organising, leading and control that may include a protocol, a code of conduct and a conceptualisation);
- Identify the role-players that might be informative or should be approached for assistance (thus building up a communication network);
- Explore the source availability of all role-players (see research question list);
- Familiarise yourself with related ID and TD environmental concepts often used in an area;
- Familiarise yourself practically with the area (a fieldtrip, the geography, geology, the environmental history and the social history);
- Actively conducting an information assessment audit of all local and international literature on the environmentally related topic from an ID focus, bearing in mind the methodological approach from a discipline-specific angle;
- TD-research connections and assessment in the research format as decided on (See Figure 1): Structure interviews and correspondence with local community members and preferably with a structured questionnaire and/or set of questions;
- Apply the unified methodology in writing and explaining the information to a broader audience (TD oriented;
- Arrange, for example, a colloquium or symposium (and more opportunities) for all the role-players who have provided expert insights and research contributions to reflect on the research findings/conclusions to ensure a valid interpretation and openness but not necessarily to conform to the historical research method; and
- Finalise the research report and communicate with key role-players and community for consideration by both government and industrial decision makers;
- ID and TD research efforts from especially HET institutions must consciously focus on gaining and developing insights regarding theory building and a refinement of the research methodology process.

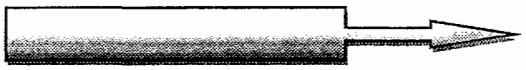
These suggestions are based on personal experience in the field of environmental crisis history. It may therefore be an incomplete account of a possible method, but it should at least be regarded as a point of departure for starting research of this nature and to serve as a springboard for further debate. Within the National Research Foundation's (NRF) core application structure for research,[106] most of the basic suggestions above for a methodology in research feature in some or other way, and may be adapted to fit into a frame of ID and/or TD research opportunities. Because TD research has multi-faceted features, a clear explanation is required when conducting research. It may be that research is carried out under a TD banner that eventually cannot exactly be "labelled" as such (compare Figure 1).

The NRF core structure for research provides a useful starting point for the identification of generic competencies within an interdisciplinary and transdisciplinary research framework. I may also contribute thinking towards, for example, ID and TD curriculum development, quality[107] assurance and accreditation.

Interdisciplinary and transdisciplinary environmental research in conducting and reporting within the North-West University's post graduate research structure

All tertiary research activities (post graduate or contract research evolving from third stream funds) reflect a basic research methodology with some extended comments on what is required,

depending on the faculty and programme offerings. In this regard the North-West University is no different. However, although disciplinary and ID research is acknowledged in the guidelines for the development and writing of a research proposal, no clear-cut explanations of either within a possible research theme are offered. TD as a 'newcomer' or 'latecomer' still needs to be assimilated in post graduate research guidelines if HET institutions are serious about ID and TD research and training. To be accommodated and innovatively implemented requires more than just editing a few words here and there in current documents serving as templates. Among others, the following ideas should be considered in a fundamental research methodological frame for research and reports/publications of this nature, whether in broader circles (by private research consultants in conjunction with academic researchers) or whether by academia and students (post graduate students). An extended version of the existing NWU research proposal framework document that serves as a guideline particularly for writing research proposals in post graduate research to fit the ID and TD environment is given below, with remarks on the positioning of History.



An extended framework for research guidelines in post graduate research
(The comments in grey serve as extended comments)

TITLE/THEME of research
(Internally or externally developed/suggested)
ID AND/OR TD & HISTORY: A theme complementing research in History and another discipline/other disciplines or specific experts (as the so-called interdisciplinary epistemic community) to fit the research 'problem space'.[108]

PROBLEM STATEMENT and substantiation
(To provide perspective with information from the literature in the research field concerned, identify the gap in current research and justify future research on the research theme as intended)
ID AND/OR TD & HISTORY: To provide perspective, with information, on the research field concerned from both the angle of History and the other discipline(s)

RESEARCH AIMS and OBJECTIVES
(To provide an outline on what is intended with the literature and empirical research as suggested. The general research aims usually focuses on the literature research and the specific objectives on the empirical research)
ID AND/OR TD & HISTORY: Although most researchers do not necessarily identify specific objectives, it may well be more utilised in ID and TD research projects where each of the disciplines involved can accentuate their role in the project to find answers to support a broader focus. In post graduate research a dominant disciplinary focus is primarily suggested with a strong TD and ID co-operation component. In ID and TD research, the research from a History perspective will require an empirical approach to the oral history component.

At least at PhD level, research elements such as Epistemology, Theoretical Framework and Methodology at an ID and TD research level should be seriously considered.

BASIC HYPOTHESES and/or CENTRAL THEORETICAL STATEMENTS
(Early expectations regarding the outcome of the research that may be proven wrong or to be correct when finalising the research project)
ID & TD: In some sciences within the Humanoria researchers are more familiarized with the concept Central Theoretical Statements. Both possibilities should be explored and accommodated in research of a multi-disciplinary nature.

A newly suggested section for ID and TD research: A transparent identification and validation of common terminology, integrative concepts and a criterion defining the disciplines/fields of interest involved.

> "To overcome technical drawbacks such as distance in communication and language, "on the fly" electronic review teams can be created, and "interpreters" be used to bridge the epistemic gap among content experts. In the absence of peer review panels to fund Transdisciplinary and Interdisciplinary research – or in the absence of customary rules – consensus on what constitutes a "quality" proposal must be negotiated. Equilibrium must be achieved respectively between the familiarity and distance of non-expertise, between transparency and opacity, expertise and subjectivity and between interdisciplinary appeal and disciplinary mastery. Methodological pluralism is key to arriving at a judgement that is both consistent and limits bias".[109]

METHOD OF INVESTIGATION

(Qualitative research based on literature and interviews and quantitative research based on empirical research such as questionnaires, laboratory and/or field tests/research). In contract research studies more serious thinking is required on the design of the research and the group involved (such as co-workers involved; the measuring instruments and/or software; pilot studies and quality control studies; procedures and research methods; data processing; ethical aspects regarding permission in conducting a specific investigation; the expected outcomes of the research and the budget or sources for funding)

ID AND/OR TD & HISTORY: All Faculties vary in the method of investigation as far as a literature focus and an empirical research focus are concerned. ***It will basically be this section that requires innovative thinking in accommodating ID and TD environmental research themes.*** From a History perspective the research methods should complement History and all the discipline(s) involved. For example, research existing theory/models on a theme from other disciplinary perspectives as well as a history of the research theme; research from a variety of disciplinary viewpoints, especially those involved and those complementing the chosen post graduate research theme or an external research requirement in contract research.

Quantitative (empirical) research processes: All disciplines normally dealing with practical fieldwork and/or laboratory research on the theme and related questionnaire development should be initiated by them as indicated in the specific subject/disciplinary related objectives). Methodological aspects that should be given some serious thought are:

Possible methods: Sampling criteria; sampling strategies
Data collection and analysis: Observation; documents; interviews; analysis; reliability; ethics of ethnographic research.

> S Baumgärtner *et al.*, suggest an operationalisation of research at three levels of analysis: Concepts-models-case studies (models may serve the following purposes: Theory development; theory testing; generalisation; understanding; explanation; prediction; decision support; communication and ways of communication; teaching)...case studies on the other hand serve as descriptive, explorative and prospective studies of a concrete real-world situation.[110]

For example, in health-related environmental research locally the following aspects of conducting the research methodology in an ID and TD context are significant:
The collection of data; the privacy of participants; the cultural traditions of indigenous communities; the characteristics of the population; safety issues when collecting data; the use of local liaison persons and acknowledgement of the ownership of intellectual property; the dissemination of results; the return of results to the community/communities.[111]
[Empirical research in the form of questionnaires do not fundamentally form part of the historical method, because History for years functioned as a basic science only, not as an applied science.]

Distinct heuristic[112] research features of history as a discipline within ID and TD research:

- *Literature research (a variety of secondary and primary publications/documents)*
- *Archival research (primary documents)*
- *Area-specific archival research (secondary & primary resource material/ documents)*
- *Interviews (academic experts, community experts; ordinary members of community)*
- *Qualitative research as part of the empirical research process: Interviews/oral memories and experiences via questionnaires and extensive, well-constructed interviews*
- Through utilising Oral History, the methodology of History as a discipline in the so-called Basic Sciences of the NWU provides a platform/gap for addressing TD research within academic structures that are not provided for in the concept definitions as discussed earlier. History's broad research focus on humankind allows for research partnerships with all disciplines in all academic faculties. For example, a key to a successful TD research partnership is the willingness of the researchers across the faculty and the human/natural sciences spectrum to 'accommodatively' adapt the research methodology of the discipline they will major in (in the absence of an opportunity to be accommodated in a faculty providing for ID or TD degrees) in a TD research theme WITHOUT ignoring the key fundamentals of the science they major in. Oral history experiences necessarily brings the researcher closer to contemporary time and therefore the implementation of empirical research methods should be accommodated by the historian in research of this nature if History wants to expand its role and function to also fulfil a role as an applied science to serve society and to support and complement the research in a broader scientific research field].[113]
- *Critically analysing data/sources retrieved (internally & externally)*
- *Writing of the report based on the research aims formulated*
- *Recommendations*

  [Not a familiar section to the History methodology but prominent in ID and TD research. The involvement of historians in making recommendations is valued within integrative research projects if all the information obtained has been critically assessed, internally and externally. Also all the impressions and outcomes regarding the oral information obtained through constructed interviews and informed expertise or society members should leave no doubt about their validity and utility in scientific reports].

A NEWLY SUGGESTED SECTION FOR ID AND TD RESEARCH

Methodology differences between the disciplines involved certainly exist (a more detailed discussion is required that clearly states the mode of disciplinary integration to be selected, and how this will be operationalised in each section of the research methodology). An organisational chart and task distribution should allow time for interaction, joint work activities, common instruments and shared decision making. Other aspects to enhance a research approach complementing ID and TD research approaches are the need to allow time to:

** Debate the meaning and individual beliefs regarding quality;*[114]

** Leadership tasks in TD research (such as cognitive leadership tasks [a focus on meaning and a mindset through a mental model; a visioning and reframing of ideas on how disciplines might overlap in constructive ways that generate new understandings and encourage collaborative work modes; structural leadership tasks that entail management issues of co-ordination and information exchange, including focus and defining objectives, recruitment of expertise and accountability for deadlines and deliverables. External boundaries must be spanned, and internal linkages and information flows brokered across different disciplinary cultures, status hierarchies and organisational structures; process task leadership ensures constructive and productive interactions among team members with the attendant subtasks of designing meetings, determining ground rules, identifying tasks that move partners toward their objectives,*

building trust and ensuring effective communication...and if necessary removing a member)[115]

** In each research phase and context, differing expectations will exist about attendant norms, values and priorities; a discussion is therefore required in each of the methodological phases as suggested, for example, in a TD collaborative model.*

In emerging methodology the traditional research approach is altered to accommodate all disciplines involved in a specific research project, each with its own set of methodologies, instruments, design models, guidelines and conceptual frameworks as anchored by a growing body of case studies and findings. Eventually they simply have to facilitate an informed definition of the task and a credible tracking of the actions and outcomes attendant to the substance, constitution and value of the research.[116] Some researchers may find these new additions an over-organised, time-consuming framework for conducting ID and TD research. However, if all aspects are at least considered to conduct a feasible all-inclusive research project, the eventual outcome(s) will benefit a smooth professional process towards completion and serving the quest for quality.

PROVISIONAL CHAPTER/REPORT/ARTICLE DIVISIONS (subsections, etc.)

ID & TD: This division usually closely interrelates with the research aims and objectives. In multidisciplinary, interdisciplinary and transdisciplinary research it is important to accommodate all disciplines in this section (each discipline with its unique methodology included) and to eventually combine the variety of foci results in the theme/research project to formulate assessment and conclusive remarks.

- *Communicating project data outcomes among researchers and regional role-players.*[117]
- *Writing of a chapter/report/article based on the research aims formulated.*

ID AND/OR TD & HISTORY: A critical feedback/discussion on the integrated disciplinary partnership from all disciplines involved and/or all disciplines and role-players involved (strengths & weaknesses) will contribute to the development of theory in ID and TD research.

REFERENCING

ID AND/OR TD & HISTORY: Methodologies of disciplines may very well differ from discipline to discipline and in this regard it may be feasible to accommodate an acceptable reference system to use in a report that all the research contributors agree on or that the leading discipline suggests. The use of the footnote technique to record and refer to data from a variety of finding places forms an essential key in a historian's research and methodological approach. If History as a discipline is to be prominent as a leading discipline in a transdisciplinary research project, this technique of referencing should be accommodated and not merely ignored.

Because 21st century needs include research features such a broader ecological sustainability, conducting ID and TD research should not be suppressed by the broader academic community but rather explored, refined and utilised to benefit the environment and humankind. In essence this fundamentally framed methodology should be as accommodative as possible to improve the reporting process and to enhance quality publications.

Experienced researchers in interdisciplinary and transdisciplinary landscape studies noted that these studies are "hard to evaluate". Winder remarks on a well-known reality in South Africa too, namely that "Conventional methods equate low publication and citation rates with poor research, even if the science is brilliant and the stakeholders love it. Few reviewers have relevant experience, and interdisciplinary work may take decades to win peer approval, even in journals that welcome our submissions.[118]

7. THE WAY FORWARD

In the discussion, key foci are to provide some impressions of the scientific debate on ID and TD environmental research, and the position of History as a discipline in research of this nature from a historian's perspective. The value of arguing this theme falls mainly within the cadre of a historian's efforts to understand trends in environmental research methodologies, how these concepts differ, how and why they are and were utilised in research at some point in the past as well as how the future of HET research and training can look like if they are utilized meaningfully.

The role of disciplinary research necessarily emerges in a debate of this nature, and so do some serious research questions in an ID or TD environment, that the supporting researchers must grapple with. Among others, the questions are:

- Researchers doing ID and TD research are positive about the reality that they fill a need as required by companies and communities. To what extend should researchers be involved? Or should they be purely disciplinary focused?
- If ID and TD research is accepted as research trends and research approaches and/or opportunities by tertiary institutions and research entities responsible for funding research, why do these institutions and entities not support the research developments and needs much more constructively? For example, proper guidance on what a fund application proposal should look like in research reflecting a TD nature should be provided. On the other hand, tertiary institutions that support ID and TD research should innovatively create opportunities for discussion and for training students (through structuring a degree complementing ID and/or TD training and research) in these research fields.
- How could a discipline, as the fundamental holder of a particular approach to knowledge and with a particular methodological framework, be accommodated and facilitated in ID and TD research? In the same process, questions arise of how to contribute to new theoretical thinking in traditional circles, as well as expanding integrative research possibilities that ensures acceptable quality reports among disciplinary peers.

Questions such as these are necessarily raised because in South Africa a number of growing pains still exist in ID and TD research (especially in TD research that, in its variety of functions, forms part of the heart of the Human and Social Sciences). From the available research conducted for this discussion, it was emphasised that serious consequences may develop within modes of integrative research if the researchers use research concepts differently. If so, it would become impossible to compare and evaluate an outcome of different research approaches. According to Klein[119] obstacles to practising an integrated form of research such as ID and TD – as expressed in literature in the past two decades, but with little progress – are the following:

- Lack of a common terminology and integrative concepts (an agreement on a common terminology is required);
- Methodology differences (an adoption of more detailed method sections in research papers that clearly state the mode of integration selected and how this was operationalised);
- A lack of critical reflection on experiences with ID and TD in environmental research, for example, leads to no progress in improving methodologies, conceptual frameworks and interdisciplinary theory.

With all these questions and realities about ID and TD as possible and as actual points of current debates; impressions on the positioning of History within the ID and especially the TD research approach in South Africa were debated.

To accentuate Langeveldt's suggestion on the research performance and outcome in a TD research environment opposing the disciplinary environment: A "commonly agreed yardstick" must be developed to "moderate the conservative forces".[120] In this regard historians active in the field of ID and TD related research could play a decisive role to support the development methodology acceptable in an integrative research environment and within History as a discipline.

The current involvement of historians in ID research in some way or another is undisputed; it is in fact historiographically old. In many ways the formal pioneering role of historians in doing ID-related research may be identified as far back as the early 20th century. In contrast, the involvement of historians in TD research as a methodology, linked particularly to 21st century research practices, is very young, not well recorded and still too vague to be properly assessed. However, it may be argued that historical research methodology has always accommodated features of the TD research approach as currently conceptually outlined. In this regard a communication and/or an involvement with the perceptions, memories and knowledge or experience of communities around a research theme have in the past been acknowledged as part of the oral memories not available in any archive, library or laboratory set-up. The discussion was argued from this perspective, and with some ideas on the role of ID and TD research according to an acceptable methodological framework for TD driven research by historians.

It seems inevitable and important that historians will have to undertake research ventures in the TD field that require thinking 'out of the box', an entry into a broader repertoire of knowledge and research associations with capable experts from a variety of disciplines (some researchers refer to it as a 'mixing' of disciplines) and informed members of community (See Figure 1). Information amnesia, as perceived especially in research on historical environmental crises, may be addressed more effectively if research experts dealing with the same locality could co-operate more efficiently within the ID and TD research approaches, but then in different phases as the Triangular Model suggests. The focus should not be only to expand the historiography and the theory of the discipline but to support contributions to community knowledge and expertise on environmental issues of concern to all.

A well-documented, multi-faceted historical account of a specific environment could most certainly be put to use in many ways within the practical focus of, for example, government, corporate bodies and consultants dealing with a variety of role-players in a destructive environment where

solutions are the remedial focus. New questions arrive from a broader focus that can be considered in further research. Among others: Environmental ethical issues and man's ability to utilise global experiences to prevent environmental crises or to find solutions are examples of themes that could be explored further.

Tress *et al.*[121] remark thus on landscape research,

> *We found many papers calling for integrative approaches in landscape ecological research, now we need research effort and publications on how integration can be achieved and how to overcome the barriers we face in this process...*

This observation is also relevant to any other integrative research effort on the environment and in any other field of study, for that matter.

Clear conceptual frameworks and improving methodologies within the process of completing ID and TD research should eventually lead to accommodating a new level of education and research opportunities with the installation, for example, of a TD degree opportunity. Researchers abroad have suggested that national funding agencies should coach the ID and TD process. An exemplary model in this regard was proposed by Laudel. [122]

Klijn believes that "professional reform and a common language would solve the problem [*sic*] of extreme specialisation".[123] Ultimately research programmes and their contexts are in a dynamic relation with societal contexts with active stakeholder participation. Seen from this angle, TD research is indeed conducted more than academics (historians included) might probably realise. According to Paapen, the growth of such research and the question of quality and relevance require special attention.[124]

As far as the role of History in ID and TD environmental research contributions are concerned, a few environmental historians in the discipline have thus far filled a substantial space in undertaking or supporting ID and/or TD research. Valuable and matured contributions had been made. The ID value within for example the Social and Human Sciences is accentuated in Stroud's (as quoted from Carruthers)[125] remarks:

> *...the environment should not be extracted from the historical equation, but employed as a site for examining other axes of power...*

Both these approaches to research can and should be accommodated in a disciplinary, a faculty and cross-faculty environments (See Figure 2 and also some thoughts in Figure 3) that present a basic structure in which a programme can be developed for students to obtain an ID or TD degree. In essence this might well be referred to as academic border crossing.[126] History as a discipline can efficiently fill a valuable space to construct research frameworks. As in other disciplines, historians should also strive towards reconstructing their thinking towards environmental themes

and crises that cannot necessarily be dealt with only within the 'traditional' and 'acceptable' historical research method, but that require a triangular multi-disciplinary research approach embedded in quality in assessing man and nature and crises in nature. As Tress *et al.*[127] state,

High quality disciplinary research is a precondition for achieving good integrated research.

Perhaps the time has arrived for disciplines such as History, and HET institutions, to actively stimulate continued research, nationally and internationally, on current trends and methodologies in ID and TD research – and to debate how these approaches can be accommodated in a disciplinary and an integrative disciplinary context especially within the Social and Human Sciences. Without this combined effort, and without the 'Humanoria' actively involved in (and even leading) research undertakings of an ID and especially a TD nature, this important aspect of progress in research will remain in isolation. It may perhaps only serve a community in the short or long term, but not resulting in any theory or methodological frameworks also necessary to reconsider and develop new training pathways that may be more career-focussed and challenging. In this regard one inevitably considers this aspect from one's own home-ground - History and the historians on all campuses who deal with TD research to a greater or lesser extent. In a more combined ID and TD research effort within the Social and Human Sciences the Humanities could, for example, participate more in undertaking social impact assessments in environmental studies within ID and TD research among the Natural Sciences where impact assessments are quite common.[128] In this, and so many other ways, the value of ID and TD environmental research, from the perspective of the Humanities, will continue to expand.

The inherent position of disciplines, and History as a discipline *per se*, will always remain fundamentally valuable, and so it should. Nobody ignores or questions it; it is its external positioning in research in an ID and TD environment (Modes 2 and 3 research) that requires construction as suggestions for innovation from within, but also from without, where 'ivory tower' practises can alter educational pathways to benefit disciplines and the communities they serve even more effectively.

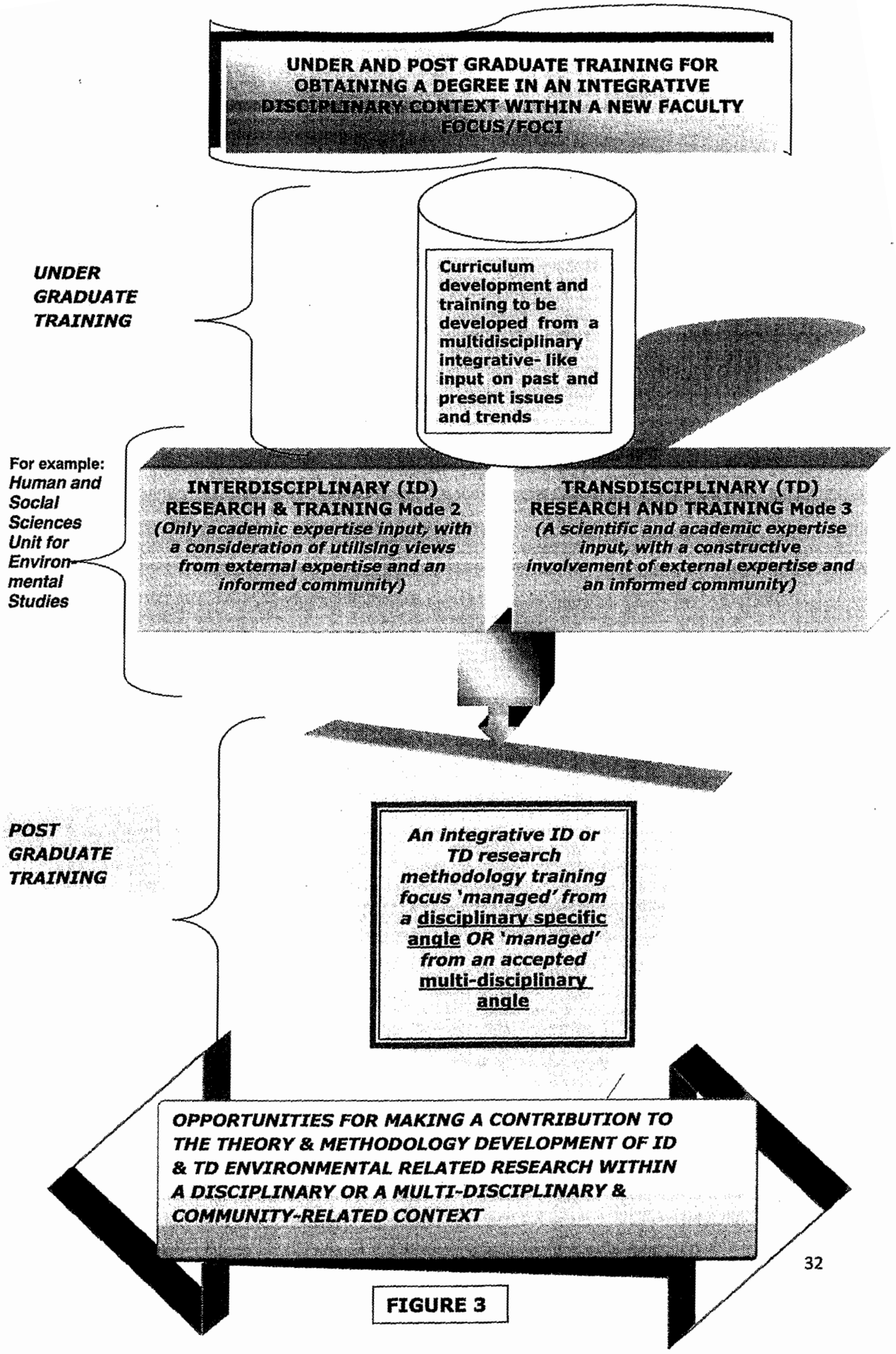

UNDER AND POST GRADUATE TRAINING FOR OBTAINING A DEGREE IN AN INTEGRATIVE DISCIPLINARY CONTEXT WITHIN A NEW FACULTY FOCUS/FOCI
UNDER GRADUATE TRAINING
Curriculum development and training to be developed from a multidisciplinary integrative- like input on past and present issues and trends
For example: Human and Social Sciences Unit for Environmental Studies
INTERDISCIPLINARY (ID) RESEARCH & TRAINING Mode 2 (Only academic expertise input, with a consideration of utilising views from external expertise and an informed community)
TRANSDISCIPLINARY (TD) RESEARCH AND TRAINING Mode 3 (A scientific and academic expertise input, with a constructive involvement of external expertise and an informed community)
POST GRADUATE TRAINING
An integrative ID or TD research methodology training focus 'managed' from a disciplinary specific angle OR 'managed' from an accepted multi-disciplinary angle
OPPORTUNITIES FOR MAKING A CONTRIBUTION TO THE THEORY & METHODOLOGY DEVELOPMENT OF ID & TD ENVIRONMENTAL RELATED RESEARCH WITHIN A DISCIPLINARY OR A MULTI-DISCIPLINARY & COMMUNITY-RELATED CONTEXT

FIGURE 3

ENDNOTES

[1] ES van Eeden, "Debating the role of history within an extensive transdisciplinary research methodology or environmental crisis research: The former Far West Rand region of South Africa as example". Paper read at the South African Historical Society Conference, Grahamstown, 5-9 July 2008.
[2] ES van Eeden, "Debating the role of history within an extensive transdisciplinary research methodology or environmental crisis research: The former Far West Rand region of South Africa as example". Paper read at the South African Historical Society Conference, Grahamstown, 5-9 July 2008.
[3] Donald Worster refers to Britain, France and the United States as the countries where environmental history flourished. See D Worster, World without borders: The internationalizing of environmental history", *Environmental Review*, 6(2), Autumn1982, pp. 8-13.
[4] See D Worster, World without borders: The internationalizing of environmental history", *Environmental Review*, 6(2), Autumn1982, pp. 8-13; D Worster (Ed.), The *ends of the earth. Perspectives on modern environmental history,* (Cambridge University Press, Cambridge Sydney, 1988).
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[6] JJ Walmsley & RD Walmsley, The environmental science research infrastructure in South Africa. A discussion document (FRD Programme Series, no. 7, December 1993), pp. 7;A5.
[7] See E Jantsch, "Towards interdisciplinarity and transdisciplinarity in education and innovation, Centre for Educational Research and Innovation (CERI). Interdisciplinarity problems of teaching and research in Universities", *Organization for Economic Cooperation and Development* , Paris, pp. 97-121 as quoted by G Tress, B Tress and G Fry, Clarifying integrative research concepts in landscape ecology, *Landscape Ecology*, 20, 2004, pp. 479-493.
[8] ES van Eeden, "Conceptual 'envirobusion' in 21st Century environmental issues in South Africa: Past practices abusing present thoughts", *New Contree*, 55, May 2008.
[9] Modes 2 and 3 levels of research are explained later in the discussion.
[10] G Tress, B Tress & G Fry, Clarifying integrative research concepts in landscape ecology, *Landscape Ecology*, 20, 2004, p. 481; B Tress, G Tress, A van der Valk & G Fry (eds.), Interdisciplinary and transdisciplinary landscape studies: Potential and limitations (Wageningen, Delta series, 2003), pp. 1-192
[11] G Tress, B Tress & G Fry, Clarifying integrative research concepts in landscape ecology, *Landscape Ecology*, 20, 2004, pp. 479-493.
[12] M Gibbons, C Limoges, H Nowotny, S Schwartzman, P. Scott & M Trow, *The new production of knowledge. The dynamics of science and research in contemporary societies* (Sage, London, 1994); J Mittelstrass, "Unity and transdisciplinarity", *Interdisciplinary Science Review*, 18(2),1993, pp. 153-157; J Moran, *Interdisciplinarity* (Routledge, London, 2002).
[13] JT Klein, "The discourse of transdisciplinarity: An expanding global field", in JT Klein, W Grossenbacher-Mansuy, R Häberli, A Bill, RW Scholz & M Welti (eds.), *Transdisciplinarity: Joint problem solving among Science, Technology and Society* (Birkhäuser, Basel, 2001), pp. 35-44.
[14] G Tress, B Tress & G Fry, "Clarifying integrative research concepts in landscape ecology", *Landscape Ecology*, 20, 2004, pp. 479-493.
[15] Also see B Nicolescu, *Manifesto of Transdisciplinarity* (Translation from the French by Karen-Claire Voss, New York, SUNY Press, 2002).
[16] G Tress, B Tress & G Fry, "Clarifying integrative research concepts in landscape ecology", *Landscape Ecology*, 20, 2004, p. 485.
[17] "Unrelated" in the context is defined as disciplines (in the natural sciences and humanities) that represents contrasting research paradigms such as qualitative and quantitative or analytical and interpretative. See G Tress, B Tress & G Fry, "Clarifying integrative research concepts in landscape ecology", *Landscape Ecology*, 20, 2004, p. 486.
[18] ES van Eeden, "Die behoefte aan dinamiese tersiêre Geskiedeniskurrikula tot voordeel van mededissiplines en gunstiger beroepsmoontlikhede", *Koers*, 58(2), 1993, pp. 195-210.
[19] G Tress, B Tress & G Fry, "Clarifying integrative research concepts in landscape ecology", *Landscape Ecology*, 20, 2004, p. 486.
[20] See next sections.
[21] G Tress, B Tress & G Fry, "Clarifying integrative research concepts in landscape ecology", *Landscape Ecology*, 20, 2004, p. 487.
[22] Compare the ideas of the following authors: M Gibbons; C Limoges; H Nowotny; S Schwartzman; P. Scott & M Trow (1994), *The new production of knowledge. The dynamics of science and research in contemporary societies* (Sage, London, 1994);J Mittelstrass, "Unity and transdisciplinarity", *Interdisciplinary Science Review*, 18(2), pp. 153-157;J Moran, *Interdisciplinarity* (Routledge, London, 2002);JT Klein, "The discourse of transdisciplinarity: An expanding global field", in JT Klein, W Grossenbacher-Mansuy, R Häberli, A Bill, RW Scholz & M Welti (eds.), *Transdisciplinarity: Joint problem solving among Science, Technology and Society* (Birkhäuser, Basel, 2001), pp. 35-44; ES van Eeden, "Die behoefte aan dinamiese tersiêre Geskiedeniskurrikula tot voordeel van mededissiplines en gunstiger beroepsmoontlikhede", *Koers*, 58(2), 1993, pp. 195-210.
[23] Compare Centre for Science Development (CSD), Human Sciences Research Council, Report, "Social Science research methodology teaching at South African tertiary institutions" (compiled by A Tothill and C Crothers), November 1997, p. 34.
[24] G Tress, B Tress & G Fry, Clarifying integrative research concepts in landscape ecology, *Landscape Ecology*, 20, 2004, pp. 487-488.

[25] See B Gray, "Enhancing transdisciplinary research through collaborative leadership", *American Journal of Preventative Medicine*, 35 (2S), 2008, pp. 124-132 in JT Klein, "Evaluation of Disciplinary and Transdisciplinary research. A literature review", *American Journal of Preventative Medicine*, 35(2s), 2008, p. 120.
[26] J Mittelstrass, "Unity and Transdisciplinarity", *Interdisciplinary Science Reviews*, 1993, 18(2), p. 156.
[27] B Nicolescu, "Towards transdisciplinary education", *The Journal for Transdisciplinary research in Southern Africa*, 1(1), December 2005, pp. 7-8, 15.
[28] Nicolescu's associations with Transdisciplinarity as a form of scientific research comes a long way. See B Nicolescu, *La transdisciplinarité, manifeste* (Le Rocher, Monaco, Collection "Transdisciplinarité"), 1996; B Nicolescu, *Manifesto of Transdisciplinarity*, 2002.
[29] JT Klein, "Evaluation of Disciplinary and Transdisciplinary research. A literature review", *American Journal of Preventative Medicine*, 35(2s), 2008, p. 116.
[30] See later when dealing with environmental crisis research in the Wonderfonteinspruit Catchment, South Africa.
[31] See G Tress, B Tress & G Fry, "Clarifying integrative research concepts in landscape ecology", *Landscape Ecology*, 20, 2004, pp. 481-482. Tress *et al.* also referred to Gibbons *et al.* in M Gibbons, C Limoges, H Nowotny, S Schwartzman, P Scott & M Trow, The new production of knowledge. *The dynamics of science and research in contemporary societies*, (Sage, London, 1994).
[32] Z Naveh, "Landscape ecology as a scientific and educational tool for teaching the total human ecosystem", in TS Bakshi and Z Naveh (eds.), *Environmental education: Principles, methods and applications* (Plenum Press, London, 1978), pp. 149-163 as quoted by G Tress, B Tress & G Fry, "Clarifying integrative research concepts in landscape ecology", *Landscape Ecology*, 20, 2004, p. 482.
[33] G Tress, B Tress & G Fry, "Clarifying integrative research concepts in landscape ecology", *Landscape Ecology*, 20, 2004, pp. 481-482. Tress *et al.* also referred to Gibbons *et al.* in M Gibbons, C Limoges, H Nowotny, S Schwartzman, P Scott & M Trow, *The new production of knowledge. The dynamics of science and research in contemporary societies*.
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[44] See V Boix-Mansilla, "Assessing expert interdisciplinary work at the frontier: An empirical exploration", *Research Evaluation*, 15, 2006, pp.17-29 as in JT Klein, "Evaluation of Disciplinary and Transdisciplinary research. A Literature review", *American Journal of Preventative Medicine*, 35(2s), 2008, p. 118; JT Klein et al., *Transdisciplinarity: Joint problem solving among science, technology, and society*...
[45] Compare JT Klein, "Evaluation of Disciplinary and Transdisciplinary research. A literature review", *American Journal of Preventative Medicine*, 35(2s), 2008, pp. 118-119; JWN Tempelhoff/ES van Eeden, Oral discussions, January 2010.
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[47] Compare C Palmer *et al.*, "Finding integration pathways: Developing a transdisciplinary (TD) approach for the Upper Nepean Catchment", in AL Wilson *et al.*, *Proceedings of the 5th Australian Stream Management Conference*, Charles Sturt University, New South Wales, 2007, pp. 306-311; Anon., "Multidisciplinary teaching and research: Knowledge of archaeology", *Interaction* "Fall, 2006 as in http://www.stanford.edu/dept/multi/interaction/1106/arch.html; F di Castri & M Hadley, "Enhancing the credibility of ecology: Is interdisciplinary research for land use planning useful?", *GeoJournal*, 13(4), pp. 299-325; Edufactory Digest, 17(8) as in http://www.mail-archive.com/cyberinternational@ml.free.fr/msg00759.html, as retrieved on 5 Feb 2010.

[48] See for example the TTRUC Model phase of research; The Aenis and Nagel Log-Frame Model; Spaapen's REP Model that focuses on a Research Embedment and Performance Profile as in Klein. Also see BK Taylor et. al, "Th evaluation of large initiatives (ELI) project at the National Cancer Institute: Key findings and lessons learned Proceedings, NCI-NIH Conference, The science of team science: Assessing the value of transdisciplinary researcl Bethesda, Oct 2006; D Stokols *et al.*, "Evaluating transdisciplinary science, Nicotine Tobacco Research", 5(1S), 200: pp.21-39; J Spaapen *et al.*, "Evaluating research in context: A method for assessment", 2nd edition, CCSCRD, 2007 as i JT Klein, "Evaluation of Disciplinary and Transdisciplinary research. A literature review", *American Journal Preventative Medicine*, 35(2s), 2008, pp. S120-121; A Robinson, M Burley, MR McGrail, M Drysdale, R Jones & Cl Rickard, "The conducting and reporting of rural health research: rurality and rural population issues", *Rural Remot Health*, 5(4), p. 427.

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[97] ES van Eeden, "Ekonomiese ontwikkeling en die invloed daarvan op Carletonville, 1948-1988: 'n Historiese stud (PhD., PU vir CHO (NWU), 1992), p. xx in which the ostensive model of doing local history by V Skipp was discussed.

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[100] L Price, "A Transdisciplinary explanatory critique of environmental education", (DPhil, Rhodes University, 2007), p. 102-133; 259-261.

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[104] Renier defines epistemology within the boundaries of a study in History as "a systematic study of History as a story See GJ Renier, *History. Its purpose and method* (George Allen & Unwin: London, 1961), p. 84.

[105] JT Klein, "Evaluation of Disciplinary and Transdisciplinary research. A literature review", *American Journal Preventative Medicine*, 35(2s), 2008, p. 119. The structure as suggested by Klein has been slightly altered.

[106] Centre for Science Development, Human Sciences Research Council, Report, "Social Science research methodolo teaching at South African tertiary institutions" (compiled by A Tothill and C Crothers), November 1997, p. 4.

[107] Also compare with the ideas on quality by F Wickinson, AL Carew & AW Russell, "Transdisciplinary researcl Characteristics, quandaries and quality", *Futures*, 38(9), November 2006, pp. 1046-1059.

[108] Compare JT Klein, "Evaluation of Disciplinary and Transdisciplinary research. A Literature review", *American Journa of Preventative Medicine*, 35(2s), 2008, p. S121.

[109] JT Klein, "Evaluation of Disciplinary and Transdisciplinary research. A literature review", *American Journal Preventative Medicine*, 35(2s), 2008, p. 122.

[110] Based on S Baumgärtner *et al.*, "Relating to the philosophy and practice of ecological economics: The role c concepts, models, and case studies in inter- and transdisciplinary sustainability research", *Ecological Economics*, 67(3) 2008, pp. 384-393.

[111] A Robinson, M Burley, MR McGrail, M Drysdale, R Jones & CM Rickard, "The conducting and reporting of rural healtl research: Rurality and rural population issues", *The International Electronic Journal of Rural and Remote Health Education, Practice and Policy*, October 2005, pp. 1-7.

[112] According to Renier "heuristic is a technique, an art rather than a science. It has no general rules, and knows few short cuts. It is, almost entirely, a deftness in the handling of specialized guide-books, a strong memory for bibliographic detail, severe self-discipline in the making, classifying and preserving of notes". See GJ Renier, *History. Its purpose and method*, p. 106.

[113] Compare with ES van Eeden, "Historiographical and methodological trends in the teaching of History in a changing South Africa", *Historia,* November 1997; ES van Eeden, "History as silent formative force in all careers with specific reference to history training and its career receptiveness", *New Contree*, November 1997; ES van Eeden, "An approach to the teaching of universal global history concepts in world history practice in South Africa", *International World History Bulletin,* Vol. XIV(1), Spring 1998.

[114] Klein is of the opinion that, if a group is pushed too quickly toward integration, crucial activities such as building rapport and exploring ways to understand how each discipline approaches a research question are short-changed and it ultimately short-changes the quality of the integration process. See JT Klein, "Evaluation of Disciplinary and Transdisciplinary research. A literature review", *American Journal of Preventative Medicine*, 35(2s), 2008, p. 120.

[115] See B Gray, "Enhancing transdisciplinary research through collaborative leadership", *American Journal of Preventative Medicine*, 35 (2S), 2008, pp. 124-132 in JT Klein, "Evaluation of Disciplinary and Transdisciplinary research. A literature review", *American Journal of Preventative Medicine*, 35(2s), 2008, p. 120.

[116] JT Klein, "Evaluation of Disciplinary and Transdisciplinary research. A literature review", *American Journal of Preventative Medicine*, 35(2s), 2008, p. 123.

[117] Also compare suggestions as indicated by JT Klein, "Evaluation of Disciplinary and Transdisciplinary research: A literature review", *American Journal of Preventative Medicine*, 35(2s), 2008, p. 119.

[118] N Winder, "On evaluation criteria", in B Tress, G Tress, A van der Valk & G Fry (eds.), *Interdisciplinary and transdisciplinary landscape studies: Potential and limitations*, pp. 146-147.

[119] JT Klein, "Evaluation of Disciplinary and Transdisciplinary research: A literature review", *American Journal of Preventative Medicine*, 35(2s), 2008, p. S120.

[120] See L Langveldt, "The policy challenges of peer review: Managing bias, conflict of interests and interdisciplinary assessments", *Research Evaluation*, 15, 2006, pp. 31-41 as in JT Klein, "Evaluation of Disciplinary and Transdisciplinary research: A literature review", *American Journal of Preventative Medicine*, 35(2s), 2008, pp. S120-121.

[121] B Tress, G Tress, A van der Valk & G Fry (eds.), *Interdisciplinary and transdisciplinary landscape studies: Potential and limitations*, pp. 489-490.

[122] See H Bruun *et al.*, "Promoting interdisciplinary research: The case of the Academy of Finland", *Academy of Finland, Publication Series*, 8/05 (Helsinki, Academy of Finland, 2005) and also G Laudel, "Conclave in the tower of Babel: How peers review interdisciplinary research proposals", *Research Evaluation,* 15, 2006, pp. 57-68 as in JT Klein, "Evaluation of Disciplinary and Transdisciplinary research: A literature review", *American Journal of Preventative Medicine*, 35(2s), 2008, p. 116.

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[124] Compare with J Spaapen, F Wamelink & H Dijstelbloem, "Towards the evaluation of transdisciplinary research", in B Tress, G Tress, A van der Valk & G Fry (eds.), *Interdisciplinary and transdisciplinary landscape studies: Potential and limitations*, pp. 148-149.

[125] See E Stroud, "Does nature always matter? Following dirt through history", *History and Theory*, 42, 2003 as quoted in Carruthers, "Transnational and transdisciplinary aspects of the environmental history of Africa" (Keynote address, International Conference on Humankind at the intersection of nature and culture (Kruger National Park, 4-6 Sept. 2006), p.3.

[126] JW Schopf and WZ Hirsch, "Strategies to foster Interdisciplinary teaching and research in a university", in WZ Hirsch and LF Weber, *As the walls of academia are tumbling down*, p. 82.

[127] B Tress *et al.*, "Potential and limitations of interdisciplinary and transdisciplinary landscape studies", in B Tress, G Tress, A van der Valk & G Fry, *Interdisciplinary and Transdisciplinary landscape studies: Potential and limitations*, Delta Series 2, 2003, p.185.

[128] Compare RJ Burdge, "Social Impact Assessment. Why is social impact assessment the orphan of the assessment process?" *Impact Assessment and Project Appraisal*, 20 (1), March 2002, pp. 3-9; ND Lewis, "Is the socio-ecological framework useful in understanding infectious diseases?" The case of HIV/AIDS", *EcoHealth*, 2, pp. 343-348.