Managing and Representing Scientific Findings about the Environment

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Abstract. Managing scientific knowledge about scientific findings is crucial. First of all, knowing what has been done before is essential in targeting new research. Secondly, a collection of formalized facts can as such be source for making new research. In this paper we discuss and present an approach to represent such scientific findings regarding research about the environment, i.e. the Earth. We focus on spatial and temporal aspects, and use deforestation in the Brazilian Amazon Rainforest as a case to illustrate our approach.

1 Managing and Opening Scientific Knowledge

It is essential to manage knowledge about existing scientific findings. First of all, it is necessary in order to target new research into unexplored areas. Moreover, knowledge about findings represented in a formalized manner support querying about what has been studied before. The fundamental motivation is to support Open Science[1], and to enable transdisciplinary research via knowledge transfer accross different research domains. For example, Climate Science and geosciences are facing big expectations from the society to solve transdisciplinary research questions about our environment—the questions which essentially touch all of us living on the Earth.

In this paper we focus on representing scientific findings about the environment. The goal is to make such findings publishable, queriable, comparable, and finally a source for new research. The particular case where we show the applicability of the approach is deforestation research. Our work builds on top of existing work on publishing large amounts of Linked Data about the deforestation and related phenomena concerning the Brazilian Amazon Rainforest[2] [2]. In essence, the goal is to support reproducibility and verifiability of research by not only providing the raw scientific data, but also machine-processable, higher level representations of scientific findings.

2 Representing Scientific Findings

Our approach of representing scientific findings about the deforestation is to relate them to space, time and themes. For example, it has been found out

[1] `http://en.wikipedia.org/wiki/Open_science`

[2] Linked Brazilian Amazon Rainforest Data (LBARD), see `http://linkedscience.org/data/linked-brazilian-amazon-rainforest/`

that economic activities are driving forces of deforestation [4]. A rise on the soybean price, or corn [3] gives rise to agricultural activities and as a result promote deforestation [1]. The main scientific finding in this example is thus briefly "soybean price rise leads to increased agricultural activities". We extract the interesting predicates such as `leadsTo`, and concepts like `SoybeanPriceRise` and `IncreasedAgriculturalActivities`. Further on, the meanings of these concepts are represented accordingly. For `SoybeanPriceRise` it is explicated that `Price` property of `Soybean` overcomes a change, namely `Rise`. To represent this finding as RDF[3] we instantiate the needed concepts and relate them with predicates. Instances are further annotated, it is for example represented where and during which time period soybean price rose. The concepts and predicates are collected in the Linked Earth Ontology (LEO), and is in the process of being published using the Linked Data technologies as an add-on to LBARD. Our approach also includes relating the concepts to those found in other ontologies such as the Semantic Web for Earth and Environmental Terminology (SWEET) [5].

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[3] The Resource Description Framework (RDF), see `http://www.w3.org/TR/rdf-primer/`