



Geographical perspectives in research and didactics from other perspectives. Inputs from J-READING

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Abstract

This work has been envisaged as a contribution with several viewpoints coming from different scientific and disciplinary sectors, able to underline the potentialities of geographical perspectives in an interdisciplinary key, both in research and didactics. These considerations are set out starting from the inputs provided by J-READING in its ten years of publications, contextualizing them in a wider framework of discussion. In particular the attention is focussed in terms of interactions with: hygiene, public health and challenges for social utility; volcanic and natural risks and the active involvement of the population; GIS models and applied research and didactics.

Keywords: Geography, GIS, Hygiene and Public Health, Research and Didactics, Volcanic and Natural Risks

1. Interactions with hygiene and public health

[Paolo Villari]

The cooperation between geography and health, particularly hygiene and public health, is very close and has strengthened over time. The analysis of the determinants of disease (whether exogenous or endogenous) is a topic of great relevance in medicine and the epidemiological approach needs the support of many other disci-

plines to give an interpretation as complete as possible of the risk factors. In this context, the close collaboration between public health professionals and geographers makes it possible to investigate, thanks also to specific technological support, how much the space (but also time) can influence the state of health and disease of populations and individuals.

Answering questions such as “who” (i.e., what are the characteristics of the population affected by the disease); “when” (i.e., what period

is considered); “how much” (i.e., how frequent is the disease in the population studied) is a fundamental objective of descriptive epidemiology. To these two *ws* and one *h* must be added a fundamental one: “where”, i.e., where is the population under study? This question is closely linked to other questions: what is the living and working environment? what is the social environment? has the population moved from one place to another? has this caused habits to change? Space, understood as the living and working environment, is a fundamental variable for interpreting health events. Space encompasses innumerable variables, each of which plays a role in reducing or increasing the risk of disease: environmental, social, dietary and lifestyle exposures. The contribution of geography to epidemiological analysis is therefore not limited to descriptive epidemiology alone, but its contribution is just as strong in answering a fifth question: “why”, i.e., why was that frequency of disease recorded in that population, in that place? thus making a major contribution to analytical epidemiology. The use of GIS technology in this context constitutes the fundamental tool for ensuring an analytical reading of the spatio-temporal spread of diseases and their determinants at different scales.

Scientific journals able to support a dialogue among different sectors can provide a relevant added value in the perspectives of advancement of the state of the art and citizenship sensitization. The possible benefits increase when these directions are developed considering both didactical and research aspects, also integrating elements and purposes connected with the third mission, a strategical activity for academic actions. In the case of public health, hygiene, and epidemiology it becomes important for enriching analysis with geospatial functionalities and models and feeding a virtuous circle of sharing and awareness of the population. In reinforcing the links between geography and public health, research and education become fundamental and necessary to win exciting challenges in the perspective of social utility.

Along these perspectives, J-READING has recently showed the possible advantages recordable through a profitable integration of knowledge, tools, and viewpoints. Particularly, since Number 2-2019, with the contribution

“The re-elaboration of John Snow’s map in a GIS environment”¹, the potentialities of a combined study making use of GIS and specific functionalities (georeferencing, editing, kernel density etc.) have been shown and the perspectives in terms of applied didactics and laboratory experience have been discussed. Innovative paths had already been previously opened up with the paper on “Geographical Health Education for knowing and preventing risk factors”² and contemporary with the just launched journal feature “Health Education” (edited by Corrado De Vito) hosting the work “Pattern of alcohol consumption of adolescents of a provincial town of the Lazio Region (Italy)”³. This wish to be opened to topics related to public health and medical geography had been expressed with Number 0-2012, with a contribution about “Parental nutrition knowledge, geographical area and food habits in Italian schoolchildren”⁴. Then, with the advent of the sanitary crisis due to the COVID-19 emergency, both the numbers of 2020⁵ focussed great attention on spatial inequalities in Italy; a joint discussion between Italy and USA about the possible use of GIS for tackling health emergencies; geographical studies on COVID-19 and lifelong education; a geographical and crosscutting look at the COVID-19 pan-

¹ Pavia D., Pesaresi C. and De Vito C., “The re-elaboration of John Snow’s map in a GIS environment. Input for transferring methodological and applied skills being inspired by a virtuous practical example of social utility”, *J-READING (Journal of Research and Didactics in Geography)*, 2, 8, 2019, pp. 91-107.

² Pesaresi C., “Geographical Health Education for knowing and preventing risk factors”, *J-READING (Journal of Research and Didactics in Geography)*, 1, 8, 2019, pp. 5-26.

³ Bevilacqua N., Morassut M., Serra M.C., Casadei G. and Cecchini F., “Pattern of alcohol consumption of adolescents of a provincial town of the Lazio Region (Italy)”, *J-READING (Journal of Research and Didactics in Geography)*, 1, 8, 2019, pp. 113-120.

⁴ Bevilacqua N., Fabbri I., Angelini V., Censi L. and ZOOM8 Group, “Parental nutrition knowledge, geographical area and food habits in Italian schoolchildren: is there a link?”, *J-READING (Journal of Research and Didactics in Geography)*, 0, 1, 2012, pp. 35-42.

⁵ <http://www.j-reading.org/index.php/geography/issue/view/18>; <http://www.j-reading.org/index.php/geography/issue/view/19>.

demic (a thematic issue with many specific themes and aspects analysed in various and interdisciplinary papers). Considerations regarding thinking through geography in times of COVID-19⁶, teaching and learning in pandemic and post-pandemic realities⁷, the impact of emergency on education and GIS opportunities⁸ build solid bases for propositional and critical considerations from which to start towards new scenarios; while the contribution about the monitoring of the infection and the development of diagnostic tools explains numerous key concepts which must be widespread among experts and population in order to avoid confusion and incorrect information⁹.

In terms of medical geography, hygiene, epidemiology, integrated approaches, *J-READING* – journal of the Italian Association of Geography Teachers (AIIG), having among its main sponsoring organizations the Department of Letters and Modern cultures of the Sapienza University of Rome – can receive strategical benefits from the experience and activities conducted within the context of the Degree course in Geographical Sciences for Environment and Health¹⁰ (interfaculty among “Letters and Philosophy”, “Pharmacy and Medicine” and “Economics” of the Sapienza University of Rome) and the Geo-Cartographic Laboratory¹¹, which is characterised by a high level know-how in geotechnologies and GIS models and elaborations. Moreover, the journal can receive inputs and contribute

to creating rigorous knowledge in the context of the AIIG initiatives, involving teachers and students at different school levels and academic degree courses, to conduct a comprehensive and active dissemination work of research results to the population.

2. Research and didactics for the reduction of Volcanic Risk

[Roberto Scandone, Lisetta Giacomelli]

The awakening of dormant volcanoes in inhabited areas provides a series of problems that are not usually dealt with by academic research.

We will discuss two main examples dealing with the renewal of activity in different volcanoes with a peculiar style of activity and different population density: namely La Cumbre Vieja in La Palma, Canary Island, Spain, and Vesuvius volcano in Italy.

These two cases offer insight into novel lines of research and their relationship with social implications that require a necessary information transfer to the people living in the areas potentially affected by volcanic activity

The recent eruption of La Palma began on 19 September 2021 after a short period of seismicity and ground deformation which started on September 11 (Instituto Geográfico Nacional-IGN)¹². The average depth of the earthquakes was between 8 and 13 km, but in the two days before the eruption they were between 0 and 6 km. With the beginning of the volcanic activity, there was a sudden decrease in the seismicity, and then in the following days it increased again forming two distinct clusters at 8-15 km and 30-40 km (IGN). The emission of a lava flow destroyed 1,291 buildings and covered a surface of 884 hectares, as of October 27 (Informe Protección Civil de Canarias). On 23 September, the IGN issued an Aviation Alert because of the formation of a low-level (<10 km) eruptive cloud which might have caused problems to the air traffic. Severe ash fall caused the temporary closure of the airport in the following days.

⁶ van der Schee J., “Thinking through geography in times of the COVID-19 pandemic”, *J-READING (Journal of Research and Didactics in Geography)*, 2, 9, 2020, pp. 21-30.

⁷ Chang C.-H., “Teaching and Learning Geography in pandemic and post-pandemic realities”, *J-READING (Journal of Research and Didactics in Geography)*, 2, 9, 2020, pp. 31-39.

⁸ Geraghty E. and Kerski J., “The Impact of COVID-19 on Geography, GIS, and Education”, *J-READING (Journal of Research and Didactics in Geography)*, 2, 9, 2020, pp. 53-66.

⁹ Angeloni A., Farina A., Ialongo C., Mancini P. and Anastasi E., “Monitoring the infection of SARS-CoV-2 and the development of diagnostic tools”, *J-READING (Journal of Research and Didactics in Geography)*, 2, 9, 2020, pp. 67-77.

¹⁰ <https://corsidilaurea.uniroma1.it/it/corso/2021/29402/home>.

¹¹ <http://geolab.uniroma1.it/geolab/it>.

¹² https://www.ign.es/web/resources/volcanologia/html/CA_noticias.html.

The surveillance networks operated by the IGN and the Instituto Volcanológico de Canarias (INVOLCAN) were able to forecast the beginning of the eruption in advance based on the observation of a week-long seismic crisis and the inflation of the ground in the area where the outbreak occurred. They are studying the eruption and providing daily or weekly resums of the volcanic activity and scientific assessment to the Civil Protection along with other Spanish scientific Institutions. The Civil Protection issues alerts based on the state of the volcano and provides the population with information regarding the progress of the eruption and the level of hazard posed by the lava flows, ash fall, and volcanic gas emission (mainly SO₂ and CO₂ emission).

It has however so far been impossible for the scientific community to provide in advance the size and type of an impending eruption and its temporal evolution. The precursory signals do not make it possible to discriminate between different eruption types, and we do not know the amount of magma that is available to be erupted.

The case of Vesuvius provides an example of the limits of our present knowledge and the need for a wider dissemination of the culture of volcanic risk.

Mount Vesuvius displays a wide spectrum of styles of activity: from mild effusive to violent explosive eruptions such as that of 79 AD which destroyed the cities of Pompei and Herculaneum¹³. It has been in a quiescent stage since 1944, but it is not possible to provide a long-term forecast on the renewal of its activity and its style so that the contingency plans in the case of its reawakening are based on the maximum, more probable event. This assumption has serious consequences as the occurrence of precursors of renewal of activity would trigger the evacuation of more than 700,000 people without the certainty of an actual eruption, or the size of the area affected by the volcanic phenomena. A second major problem arises from the assumption of a complete handling of an emergency by the National Civil Protection, not taking into account a

possible failure of the assumptions regarding the chosen scenario.

All these problems require a decisive change of perspective of the research necessary for a long-term forecast of the size and character of an impending eruption, its temporal development and an understanding of the long-term state of a volcano that can give a clue to its future behavior.

At the same time, it is necessary to teach local inhabitants both the limits of scientific knowledge and its possible failures but also the need to make choices based on reliable information, not influenced by social media rumors.

The examples here considered are useful to understand and highlight the importance which can be gathered from scientific journals able to connect research, didactics and awareness of the population. In these perspectives, among the scientific and geographical journals, *J-READING* plays a notable role and, in fact, various works in the ten years of publications have tackled aspects concerning interdisciplinary research and didactics for the reduction of volcanic risk; and many examples have been presented in different places of the world, often with the added value provided by remote sensing, GIS, geospatial analysis, photos by field works.

For example, some contributions have focused the attention on:

- death, survival and damage during the famous 79 AD Eruption of Vesuvius which destroyed Pompeii and Herculaneum¹⁴, also creating a lesson in natural history¹⁵ and discussing hypotheses and crucial aspects for reducing risk exposition¹⁶;

¹³ De Vivo B., Scandone R. and Trigila R. (Eds.), "1993 Mount Vesuvius", *Journal of Volcanology and Geothermal Research* (Special Issue), 58.

¹⁴ Scandone R., Giacomelli L. and Rosi M., "Death, Survival and Damage during the 79 AD Eruption of Vesuvius which destroyed Pompeii and Herculaneum", *J-READING (Journal of Research and Didactics in Geography)*, 2, 8, 2019, pp. 5-30.

¹⁵ Scandone R. and Giacomelli L., "Vesuvius, Pompei, Herculaneum: a lesson in natural history", *J-READING (Journal of Research and Didactics in Geography)*, 2, 3, 2014, pp. 33-41.

¹⁶ Scandone R. and Giacomelli L., "The reduction of volcanic risk in the Neapolitan area", *J-READING (Journal of Research and Didactics in Geography)*, 0, 1, 2012, pp. 25-33.

- the volcanic phenomena between media simplification and the need for a better understanding of human-environment interaction¹⁷;
- the use of remote sensing and imagery-interpretation as powerful and multifaced tools for studying volcano environment, characteristics and activity¹⁸;
- GIS modelling and multiphase procedures for analysing areas exposed to high volcanic risk and supporting landscape reconstruction¹⁹;
- synergic and coordinated use of GIS applications and drones for analysing volcanic and seismic risks in the pre and post event²⁰ and to optimise the first geodynamic post-event phases and face emergencies²¹, expanding the proposals and analysis also in the case of seismic and other risks²².

¹⁷ Giacomelli L. and Scandone R., "Volcanic phenomena between media simplification and the need for a better understanding of human-environment interaction, with particular reference to Italy", *J-READING (Journal of Research and Didactics in Geography)*, 1, 10, 2021, pp. 53-70.

¹⁸ Fea M., Giacomelli L., Pesaresi C. and Scandone R., "Remote sensing and interdisciplinary approach for studying volcano environment and activity", *J-READING (Journal of Research and Didactics in Geography)*, 1, 2, 2013, pp. 151-182.

¹⁹ Pesaresi C. and Pavia D., "Multiphase procedure for landscape reconstruction and their evolution analysis. GIS modelling for areas exposed to high volcanic risk", *J-READING (Journal of Research and Didactics in Geography)*, 1, 7, 2018, pp. 17-41. It is worthy of note that this paper obtained the Award of remarkable methodological value and notable innovativeness assigned by Esri Italia (http://j-reading.org/download/ESRI_Price_2018.pdf).

²⁰ Pesaresi C. and Lombardi M., "GIS4RISKS project. Synergic use of GIS applications for analysing volcanic and seismic risks in the pre and post event", *J-READING (Journal of Research and Didactics in Geography)*, 2, 3, 2014, pp. 9-32.

²¹ Baiocchi V. and Pesaresi C., "GIS4RISKS: Geographic Information System for Risk Image –Safety Key. A methodological contribution to optimise the first geodynamic post-event phases and to face emergencies", *J-READING (Journal of Research and Didactics in Geography)*, 2, 4, 2015, pp. 25-37.

²² Pesaresi C. and Gallinelli D., "GIS procedure to evaluate the relationship between the period of construction and the outcomes of compliance with building safety standards. The case of the earthquake in

Therefore, J-READING seems to have all the credentials to play a leading role in the framework of scientific journals able to connect aspects regarding research, didactics and third mission in the field of volcanology and geography of risks, according to innovative perspectives, interdisciplinary approaches and geotechnological keys.

3. Research and didactics for enhancing GIS use

[Maurizio Pollino]

I started to deal with GIS, and more in general with geographical science, at the beginning of the 2000s. At that time, during workshops or talks with a non-specialised audience, when I presented my activities I usually needed to make a preamble (also showing a couple of slides) to explain what GIS was and what its capabilities and strengths were. That has been a common situation at least up to the second half of the 2000s. Then, something changed: GIS techniques and approaches started spreading outside the circle of experts, with a large diffusion in several sectors spanning from the research to business applications. What happened next is well-known.

The awareness of GIS potentialities and usefulness is nowadays widely recognised, also among non-specialists. Undoubtedly, such aspect can be connected to the establishment of GIS (or, in a broad sense, GIS-related) academic courses in many universities across the world. In this framework, research institutions such as ENEA (the Italian National Agency for New Technologies, Energy and Sustainable Economic Development) actively supported the education

L'Aquila (2009)", *J-READING (Journal of Research and Didactics in Geography)*, 2, 7, 2018, pp. 41-58; Cara P., "The role of geographic data and Open geo-Data in the framework of Open Government in disaster management operations: 2016 Central Italy earthquake emergency", *J-READING (Journal of Research and Didactics in Geography)*, 2, 7, 2018, pp. 27-39; Kerski J.J., "Understanding Our Changing World through Web-Mapping Based Investigations", *J-READING (Journal of Research and Didactics in Geography)*, 2, 2, 2013, pp. 11-26.

and training activities in collaboration with the universities, making available qualified personnel, advanced laboratories, experimental facilities and excellent instruments.

Thus, I would like to use as an example my experience as researcher at ENEA. In particular, as tutor of several internships, I have had the opportunity to observe how the cooperation between the academic world and the research institutions has been able to successfully promote and support the diffusion of GIS expertise among the students. Such factors have contributed to developing a new generation of scholars and experts, that consider geographic information as a common and fundamental tool to develop their activities and projects.

The Lab where I work is named APIC (“Analysis and Protection of Critical Infrastructures”). As ENEA-APIC researchers, we have a long-lasting experience in using geospatial information layers to extract value-added information for the analysis of the risks related to Critical Infrastructures (CI: power network, telecommunication, transportation system, pipelines, etc.)²³. To this end, we have developed the CIPCast platform (“Critical Infrastructure Protection risk analysis and forecAST”), a GIS-based Decision Support System (DSS) for CI protection, environmental analysis and risk assessment²⁴. Thanks to such expertise, during the last decade, the Laboratory has been involved in various EU and National-funded projects, as well as in some research collaboration with public bodies or private enterprises.

Thus, one of the peculiarities of the internships at ENEA is to set them in the context of

on-going research projects. In such a way, the interns can work on concrete and practical activities, also collaborating in the achievement of specific project goals. The development of the CIPCast platform has been, and continues to be, the typical focus of many ENEA-APIC internships, especially those carried out along with the “Sapienza” University of Rome in the framework of the “Geographical Sciences for environment and health” and “Territory’s management and enhancement” degree courses.

A distinctive feature of the CIPCast platform is represented by its WebGIS interactive interface, which allows the users to access, visualise and query many geospatial data and information layers: basic cartography, thematic maps, census data, hazard and risk maps, CI topology and characteristics²⁵, cultural heritage data²⁶ etc. To this end, it is fundamental to properly organise and structure those GIS layers, in order to analyse them and produce the CIPCast outputs: risk maps and damage scenarios in the case of calamitous events due to natural hazards (e.g. heavy rainfalls, floods, earthquakes²⁷, landslides).

In the light of this, the experiences of internships based on the CIPCast development is a typical example of a sort of “win-win” strategy. On the one hand, the Lab can have the opportunity to rely on the active contribution of the interns, who are involved in carrying out specific

²³ Di Pietro A., Lavallo L., La Porta L., Pollino M., Tofani A. and Rosato V., “Design of DSS for Supporting Preparedness to and Management of Anomalous Situations in Complex Scenario”, in Setola R., Rosato V., Kyriakides E. and Rome E. (Eds.), *Managing the Complexity of Critical Infrastructures. Studies in systems, decision and control*, vol. 90, Cham, Springer International Publishing, 2016, pp. 195-232.

²⁴ Taraglio S., Chiesa S., La Porta L., Pollino M., Verdecchia M., Tomassetti B., Colaiuda V. and Lombardi A., “Decision Support System for smart urban management: resilience against natural phenomena and aerial environmental assessment”, *International Journal of Sustainable Energy Planning and Management*, 24, 2019.

²⁵ Giovinazzi S., Pollino M., Kongar I., Rossetto T., Caiaffa E., Di Pietro A., La Porta L., Rosato V. and Tofani A., “Towards a decision support tool for assessing, managing and mitigating seismic risk of electric power networks”, in Gervasi O. et al. (Eds.), *Computational Science and Its Applications*, ICCSA 2017, Lecture Notes in Computer Science, vol. 10406, Cham, Springer, 2017.

²⁶ Giovinazzi S., Marchili C., Di Pietro A., Giordano L., Costanzo A., La Porta L., Pollino M., Rosato V., Lückerrath D., Milde K. and Ullrich O., “Assessing Earthquake Impacts and Monitoring Resilience of Historic Areas: Methods for GIS Tools”, *ISPRS International Journal of Geo-Information*, 10, 461, 2021.

²⁷ Pollino M., Di Pietro A., La Porta L., Fattoruso G., Giovinazzi S. and Longobardi A., “Seismic Risk Simulations of a Water Distribution Network in Southern Italy”, in Gervasi O. et al. (Eds.), *Computational Science and Its Applications*, ICCSA 2021, Lecture Notes in Computer Science, vol. 12951, Cham, Springer, 2021.

project tasks or in empowering the CIPCast platform with new features. On the other hand, the students can improve their expertise, learn new concepts and – more in general – take advantage of various aspects, such as the Lab facilities, the researchers' support and the project context. In addition, the innovative contents of the research project represent a unique occasion for the students to appreciate and comprehend the new advances in GIS discipline and related applications.

In the perspective of a strong link between applied research and laboratory didactics and education, interesting contributions have been published in *J-READING* in the past ten years, offering a wide panel of exemplifications coming from different countries. A scientific journal able to collect papers i.e. concerning the integration of geographic skills with active learning²⁸, the environments of learning environments²⁹, preparing and debriefing geography fieldwork for opening classroom dialogue³⁰, journeys through the world of GIS, teaching and students' core knowledge³¹, GIS in school education³², in Geography textbooks³³, in Geography Teaching³⁴ or for understanding our chang-

ing world³⁵, just as teachers' in-service training in the geographic information system³⁶ or the comparison between learning geography with GIS online and GIS desktop³⁷ constitutes a notable value which provides important examples of applied research in geographical didactics. At the same time, contributions which make use of advanced tools and GIS methodologies in the field of natural risks³⁸ open up numerous perspectives for profitable collaborations among academies, laboratories and different research institutions, also at distance and always keeping in mind the importance of active involvement and awareness of the citizenship. A journal like *J-READING* can be a suitable editorial seat to rouse and support initiatives finalized to join up interdisciplinary and laboratory approaches, also comparing planning phases and results coming from different countries.

²⁸ Artvinli E., "Integrate geographic skills with active learning in geography: a case of Turkey", *J-READING (Journal of Research and Didactics in Geography)*, 0, 1, 2012, pp. 43-50.

²⁹ Tani S., "The environments of learning environments: What could/should geography education do with these concepts?", *J-READING (Journal of Research and Didactics in Geography)*, 1, 2, 2013, pp. 7-16.

³⁰ Oost K., de Vries B. and van der Schee J., "Preparing and debriefing geography fieldwork: a scenario for open classroom dialogue around a core curriculum", *J-READING (Journal of Research and Didactics in Geography)*, 2, 5, 2016, pp. 63-77.

³¹ Manning A., "A personal journey through the world of GIS, teaching and development of students' core knowledge", *J-READING (Journal of Research and Didactics in Geography)*, 1, 2, 2013, pp. 33-45.

³² Roosaare J. and Liiber Ü., "GIS in school education in Estonia –looking for an holistic approach", *J-READING (Journal of Research and Didactics in Geography)*, 1, 2, 2013, pp. 47-56.

³³ Martinha C., "GIS presence in Geography textbooks – a highway to spatial thinking development?", *J-READING (Journal of Research and Didactics in Geography)*, 1, 2, 2013, pp. 57-66.

³⁴ Azzari M., Zamperlin P. and Landi F., "GIS in Geography Teaching", *J-READING (Journal of Research and Didactics in Geography)*, 2, 2, 2013, pp.

27-42; Borruso G., "Web 2.0 and Neogeography. Opportunities for teaching geography", *J-READING (Journal of Research and Didactics in Geography)*, 2, 2, 2013, pp. 43-55.

³⁵ Kerski J.J., "Understanding Our Changing World through Web-Mapping Based Investigations", *J-READING (Journal of Research and Didactics in Geography)*, 2, 2, 2013, pp. 11-26.

³⁶ Lay J.-G., Chi Y.-L. and Chen Y.-W., "Teachers' in-service training in geographic information system (GIS) and different integration behaviors in lectures", *J-READING (Journal of Research and Didactics in Geography)*, 1, 4, 2015, pp. 29-41.

³⁷ Demirci A., Karaburun A. and Arslan S., "Comparing learning geography with ArcGIS online and desktop", *J-READING (Journal of Research and Didactics in Geography)*, 1, 8, 2019, pp. 27-40.

³⁸ Pesaresi C. and Gallinelli D., "GIS procedure to evaluate the relationship between the period of construction and the outcomes of compliance with building safety standards. The case of the earthquake in L'Aquila (2009)", *J-READING (Journal of Research and Didactics in Geography)*, 2, 7, 2018, pp. 41-58; Pesaresi C. and Pavia D., "Multiphase procedure for landscape reconstruction and their evolution analysis. GIS modelling for areas exposed to high volcanic risk", *J-READING (Journal of Research and Didactics in Geography)*, 1, 7, 2018, pp. 17-41; El-fengour A., Bateira C., El motaki H. and Laatiris M., "Validation of landslide susceptibility using a GIS-based statistical model and Remote Sensing Data in the Amzaz watershed in northern Morocco", *J-READING (Journal of Research and Didactics in Geography)*, 2, 8, 2019, pp. 31-42.