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JOURNAL

PROJECT

SPIRE - Smart Post-Industrial Regenerative Ecosystem

Baia Mare, Romania

TOPIC

Sustainable use of land and nature based solutions

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SPIRE Final Journal

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SPIRE is an ambitious Urban Innovative Action project managing land use sustainably and integrating Nature-Based Solutions (NBS) to re-claim five polluted sites in Baia Mare.

The primary SPIRE challenge is to test an integrated, innovative strategy to:

- Recover heavy metals contaminated lands through phytoremediation processes and revalorize land for sustainable use in the long term;
- Give back these former polluted lands to the community;
- Support participation, co-creation, and behaviour shift, leveraging smart digital solutions.
- Co-create new economic bio-based development models;
- Find alternatives to fossil fuels to promote sustainable energy transition.

The main SPIRE proposed actions are:

- Create a reward system (iLEU), to enhance citizens' environmental behaviour, engagement and eco-entrepreneurship;
- Open a SPIRE HUB in the city centre for co-design, training and mentoring activities;
- Upload a dynamic GIS Atlas and remediation toolkit to support the renaturation and phytoremediation on five pilot sites;
- Start a long-term urban redevelopment through the co-creation of new adaptive urban landscapes;
- Apply mitigation and adaptation risk measures that enable the project to be a reference for European urban resilience.

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If you want to know the What, Why, Who and How of SPIRE, please, follow this link

Executive summary

Figure 2. Baia Mare. Source: Amaia Celaya Alvarez

This is the final journal of the Smart Post-Industrial Regenerative Ecosystem (SPIRE) project since its creation on 1st September 2019. After four years of work, several lessons were learnt related to Nature-Based Solutions and phytoremediation, public health, knowledge-building, environmental behavioural shifting processes and bio-energy and bio-industrialization.

SPIRE emerged from real and tangible needs:

- The need to move from a polluted city towards a green one
- The need to transform industrial areas into green public spaces
- The need to integrate green areas within the built environment
- The need to involve the community in this green transformation

During the fourth year of the project's implementation, the city has continued its transition from its past as Romania's mining capital towards a new sustainable development model. Romplumb, Ferneziu, Colonia Topitorilor, Urbis, and Craica are the five pilot sites being reclaimed in the city that will be integrated into the future network of healthy natural and semi-natural areas within the BM 2050 Master Plan sustainable use of land strategy. An iGIS smart and iLEU digital token platforms have been created, on the one hand, to collect and monitor data; on the other hand, to leverage the phytoremediation processes as an opportunity to change the citizens' behaviour related to environment and climate.

The municipality works now on lessons learnt compilation and capitalization of the experiences to become a reference for any other city that wants to undertake a de-pollution process in their soils through nature-based solutions, and also to leverage these processes to boost the urban circular economy possibilities.

Partnership:

- City of Baia Mare
- Urbasofia SRL
- Indeco Soft
- Transilvania Branch of the Romanian Association for Electronic Industry and Software (ARIES Transilvania)
- Baia Mare Metropolitan Area
- University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca (USAMV)
- Green Energy Association (GEA)

1. Project's progress

The estimated results proposed by the SPIRE project in 2019 were based on the triple-bottom-line, along with risk reduction measures:

- **People:** SPIRE wanted to foster awareness, commitment and knowledge related to the environment and health to involve stakeholders and citizens in sustainable practices to provoke a behavioural shift towards an ecological culture.
- **Planet:** SPIRE is in the process of recovering approx. 7 ha (out of the 627) of polluted land through an adaptive agenda capable of delivering both short-term and long-term results through the combination of phytoremediation techniques and landscaping strategies to not only restore but re-connect these abandoned areas with the urban system, making feasible long-term metropolitan plans possibilities in the city.
- **Prosperity:** SPIRE is harnessing underutilized local resources to stimulate the development of bio-based business models and green building materials along with bio-based energy, with the final effect of reducing the total GHG emissions in Baia Mare.
- **Risk (s):** Beyond the sustainability scheme, SPIRE also considered the risk logic through the application of adaptive, climate resilient and risk reduction strategies. The project has improved the urban environment and revitalised the urban land while strengthening risk governance, enhancing preparedness, and enabling an effective response to recover and "build back better."

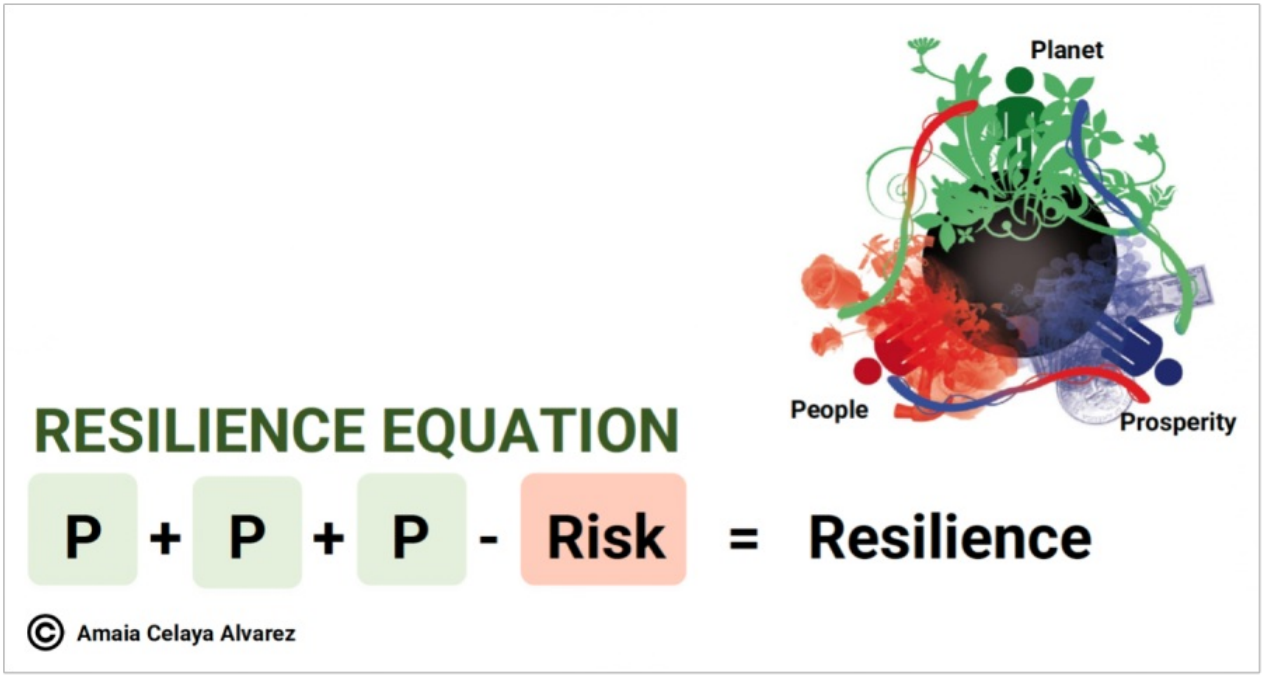

Figure 3. Triple bottom line and the resilience equation. Source: Amaia Celaya Alvarez

1.1 People

Figure 4. Planthatlon - October 2022. Source: Amaia Celaya Alvarez

The SPIRE social transformation has been built upon a strategic multi-stakeholder framework that has shifted the urban social dynamics into a new model, through:

1. **Citizen engagement:** The project has stimulated awareness, knowledge sharing and capacities related to environmental sustainability. It is a high priority now and in the future.
2. **Co-creation processes:** Through co-creation workshops, consultations, and public events, the project broadens civic initiatives owned by citizens. It is a learned tool that will continue to be used to ensure consistency between citizens and the public sphere.
3. **Active community participation:** Through Planthlatons, Donate your Christmas Tree campaigns and inSPIREathons, the project is showing a proactive way of being a citizen. It has defined an inspiring set of activities that have impacted the way citizens understand urban nature and environmental behaviour, and that came to stay.

1.2 Planet

Nature-Based Solutions phytoremediation techniques – at the core of the SPIRE project - have used plants to clean up contaminated land and remove Heavy Metals from the soil. Energy willows and other selected species have been planted, following the criteria of the remediation Toolkit guided by the Conceptual Adaptive Site Management Application (CASMA). They provide a specialist catalogue based on soil HMC, remediation capacity per planting cycle, biomass harvest cycle, the cost-effectiveness of soil preparation and plantation, primary and secondary potential applications, cascading uses, and a set of design options. Preexisting plant species on the sites have been included because of their optimal adaption to the local conditions.

Figure 5: Colonia Topitorilor's final co-created design. Source: Amaia Celaya Alvarez

After the consultation and collaborative workshops, some urban solutions and interventions were co-designed and co-created in Romplumb, Ferneziu, Urbis and Craica, and particularly in Colonia Topitorilor, the site has been transformed into a park during the project´s implementation.

1.3 Prosperity

Bio-based business models are behind the bio-based good practices performed. The city takes advantage of the resulting biomass derived from nature-based solutions to stimulate local value chains within a circular performance scheme. A novel business model methodology was developed thanks to the SPIRE Start-Ups Mentoring Programme that experimented, tested, and implemented innovative projects for sustainable land use and Nature-Based Solutions (NBS), with the phytoremediation techniques applied in the city at the core. Local resilient-based sustainable entrepreneurship has been enabled, attracting talent from the local community and securing the creation, development, and implementation of green businesses' ideas and models at local and regional levels.

In complementarity with the mentoring program, several courses on bio-based materials and nature-based by-products have been conducted at the Technical University of Cluj-Napoca - North University Centre of Baia Mare-Faculty of Science in collaboration with the Association of Maramures Entrepreneurs. These courses combined knowledge from biological sciences, economic disciplines, and industrial expertise to enable new bio-based schemes in the area.

Figure 6: Neni ţ escu College biomass power plant. Source: SPIRE Project.

As for bioenergy possibilities, a biomass boiler (60 kW capacity) has already been installed at Technical High School "C. D. Neniţescu" fully equipped. An auxiliary space has been located near the boiler to store the usable biomass in the boiler.

1.4 Risk Reduction

Baia Mare's urban system is vulnerable to extreme climate phenomena due to its geographical position in an intra-hill valley surrounded by mountains. The main natural hazards of this type are the likelihood of hail and thunderstorms and fog and acid deposition. This orographic and climatic situation, combined with its industrial past renders the city fragile to climate change, without forgetting the severe public health consequences of pollution.

Extremely hot and cold episodes, urban heat island effects, lack of access to walking pathways and bike lanes, and green infrastructures unfairly distributed within urban space; in addition to the wide availability of tobacco, alcohol and unhealthy foods and beverages; drive the so-called Non-Communicable Diseases (NCD) epidemic.

Figure 7: Baia Mare landscape. Source: Amaia Celaya Alvarez

Adaptation resilience-building measures reduce the risk of disaster from extreme weather events and carry many public benefits (including improving the environmental quality of air, water, and soil. Increasing accessible green spaces is one of the critical features of adaptive cities that follow the WHO Urban Health Initiative (UHI), acting against urban pollution, promoting physical exercise, and leveraging the urban environment as a tool to promote physical and mental health. The Baia Mare's vulnerability to the climate emergency is expected to be diminished, while the citizens' health is expected to be improved thanks to the actions already undertaken.

1.5 Next steps for long-term project´s sustainability

SPIRE has focused during the last year on ensuring the finalization of the urban interventions derived from the co-creation dynamics and activities, the last works related to Casa Schreiber refurbishment, the biomass boiler operationalization and the use of the first iLEUs. Also, the Metropolitan Bio-based Strategy and Master Plan 2050 for Circular Communities has been put in place.

Figure 7: SPIRE participatory processes. Source: SPIRE project

What else is expected by the SPIRE team for the foreseen future:

1. Continue plantations on all plots to test the best phytoremediation methods on plots contaminated with heavy metals, including mycorrhizae.

2. Casa Schreiber has become a centre to initiate and test innovative ideas for urban green transformation. The building premises will be used for meetings and workshops to co-lead the community development: "living laboratories" inception meetings co-designed with the community already planned.

3. Local economic businesses to be stimulated, particularly those on the circular schemes, by launching and incubating new bio-based companies and construction materials, with the local business environment's involvement in biomass use.

Figure 9: SPIRE Hub. Source: SPIRE project

4. Makerspace facilities to be used for new start-up ideas in the circular economic field.

5. Continuation of collaboration with educational institutions in Baia Mare (Planthlatons, drawing caravan in schools, work and creative workshops in the Hub and Makerspace)

6. Continuation of the "Donate the Christmas tree" campaign.

7. Citizens' involvement and sustainable local entrepreneurship stimulation, through iLEU, expanding its use from the strict use in the Makerspace and Hub to iLEUs circulation within the business environment through:

a. Finding a solution to pay fees and taxes with iLEU

b. Involving economic partners in the use and circulation of iLEU

c. Implementing new solutions for the use of iLEU.

2. Generated Knowledge

2.1 Lessons learnt and recognition

- Pollution is one of the most significant environmental challenges worldwide, and the phytoremediation techniques tested in Baia Mare and the lessons learnt have great potential for scalability and marketability. The lack of short-term results prevents some cities from investing in these proposed measures. However, with the SPIRE project as a global reference, the real impact and long-term positive consequences are becoming evident over time. To change the community mindset, it is necessary to establish a concrete program of actions that the community must undertake to reduce pollution and its impacts.

- After careful analysis of the energetic willows and other vegetal species growing evolution in sites, the SPIRE team now knows the optimum species seeds, where to get them, when to plant them, and how to do it properly to get the maximum impact soil decontamination.
- The iLEU reward system and platform, supported by the iGIS smart system already in place, hold more possibilities (timebank, potential migrant target, and local entrepreneur's network linkages). It highlights, again, the need for culture-shifting towards resilience, not only in citizens' environmental behaviour but also in legal frameworks and procedures. These groundbreaking initiatives will only occur by allowing ourselves and our procedures to be adaptable, reflexive, and transformative.
- Concerning new businesses (along with mentoring programmes), other supporting modalities must be explored for a

local authority to support them, regardless of the funding sources at the national or European level.

- A language more accessible to the community is needed for presentation, so a toolkit was produced as a comic book. It was also noticed that concrete action formulation is required, such as Planthlatons or Christmas Tree Donation.
- Since young people were the most involved in the project's activities, the approaches should be reformulated to address them and stimulate the desired mindset shift.

Implementation Challenge	Level	Level	Level	Level
1. Leadership	Medium	Medium	Medium	Low
2. Public procurement	High	High	Medium	Medium
3. Participative approach	Medium	Medium	Medium	Medium
4. Cross-department working	Low	Low	High	Low
5. Monitoring& evaluation	Low	Low	Low	Low
6. Communication	Medium	Medium	High	Medium
7. Upscaling	Medium	Medium	Medium	Medium

Figure 10: SPIRE Challenges. Source: Amaia Celaya Alvarez

The SPIRE project has already been recognized as:

- Finalist at the International Association of Horticulturists (AIPH) award in the Living Green for Urban Infrastructure and Liveability category
- Finalist at the EIPA – the European Institution of Public Administration Awards – in the category Green Transition and Sustainability.
- Deserving initiative at the 6th Guangzhou International Award for Urban Innovation (Guangzhou Award)
- Nominee at the German SDG & UNIDO Innovation Award 2023 in the category "Cities, Municipalities & Districts" at the International Vienna Energy and Climate Forum (IVECF).
- Innovation award winner at the Smart City Expo World Congress Barcelona 2023.

Figure 11: Innovation award winner at the Smart City Expo World Congress Barcelona 2023. Source: Amaia Celaya Alvarez

2.2 2.2 Recommendations to other urban authorities who wish to implement similar innovative projects

- Being innovative means being ambitious and "connecting dots" that perhaps would have never been linked before (phytoremediation, health, participation in public spaces and strategies, urban fabric network, bio-based economic models, new digital solutions, etc.)
- Being innovative and ¨ thinking out of the box" connotes performing interdisciplinary in-depth analysis and re-defining

what the questions are to get the right answers.

- Being innovative aims to "empathise" with the problem, potentially "unlearn" the usual way in which things have been done, and "anticipate" problems before they arrive.
- Being innovative implies multi-level, inter-sectoral and multi-stakeholder awareness, information, collaboration, and decision-making, always counting on citizens and people in the most vulnerable situations and "leaving no one behind".
- Being innovative needs the generation of inclusive spaces and activities to promote social interaction and co-creation to achieve common objectives, with a specific focus on young people and the gender gap.
- Being innovative needs a tailored strategy – a clear action plan and a roadmap - and adaptable tactics – actions to get shared involvement, commitment, alignment and inter-operability.
- Being innovative aspires to robust reporting derived from well-designed indicators and data collected and a mature inclusive narrative to reach emphatic lessons learnt and further innovation.
- Being innovative comes along with a profound commitment to searching for short and medium-term results, and always with shared long-term outcomes in mind.

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3. Conclussions

3.1 The expert's final reflection and "evaluation" of the project

At the national and local scale, The SPIRE project has gained visibility at the city level using iLEUs, and locating the SPIREHub and MakerSpace at the city center in Casa Schreiber. At the global scale, the project is an example of the UIA Just Urban Transitions, emphasizing both the need for a sustainable, green recovery and the importance of supporting the most vulnerable people, most affected by climate change consequences and transition policies. The city also broadens its networks by participating in several national and international events and applying for varied global awards.

- It is imperative that Baia Mare Municipality puts the needed internal human and budgetary resources on the table to boost the city´s potential to continue with the work on soil de-pollution, bio-based circular economic schemes, social cohesion and trust strategies, and metropolitan plans, among others.

The SPIRE project has overcome the constraints it found along the way (legal procedures for machinery and plant acquisition, landscaping works, etc.). The correct vegetal species and planting procedures have been finally implemented on pilot sites. Colonia Topitorilor urban intervention has been totally implemented.

- iLEU regulations have not been totally solved, due to the current monetary and fiscal legislation that didn't allow the Local Authorities to use the public budget for such an innovative mechanism. To solve this issue and smooth potential similar processes in the city, the project must pave the way for real, greener citizen behaviour and a cultural shift.

Surveys, mentoring courses, workshops related to iLEU, green business and, iGIS, and plantations have also been completed. In June 2023, the project had its last co-creation and co-production workshop with students in the SPIRE Hub.

- Resources must be allocated for the SPIRE Hub and Makerspace to keep being the heart of the green transformation in the city through courses, workshops, mentoring activities and new strategies to ensure and enlarge the use of the iLEU.

The iGIS monitoring system in place includes on-site ground measurements of pollutants and satellite imagery, as well as predictive algorithms for site improvements - due to phytoremediation activities – in the foreseen future.

- The Key Performance Indicators (KPI) in the next projects should include International Agenda Indicators (SDGs, Paris, Sendai and New Urban Agenda).

Figure 12: SPIRE co-creation session June 2023. Source: Amaia Celaya Alvarez

3.2 Project´s legacy

iLEU: The reward-system immaterial Local Environmental Utility (iLEU) trust in the local business environment and economic green activities, enhancing commercial cooperation between local actors.

5 companies have accepted iLEU: Creative Space-Consulting in strategic planning Service: Training - use of satellite data (Maximum amount payable in iLEU: 25%) / Lansec- Organizing LaserTag games at the customer's location (Maximum amount payable in iLEU: 25%) / One-IT - Supplier and integrator of IT equipment, customized IT solutions and services (5% of the value of IT equipment and solutions and 20% of the value of the IT services provided by One-IT) / Inside Media- Customization of promotional items: t-shirts, pens, keychains, mugs, etc (Maximum amount payable in iLEU: 50% of the customization cost) / Cloudscape Binary VPN- Linux web server hosting with management system, file hosting, databases, email addresses (Maximum amount payable in iLEU: 100%). iLEU information available: https://spire.city/index.php/parteneri-ileu/

iGIS platform: The smart iGIS system has located the five pilot sites, providing a complete overview of the intervention. It organizes and shows information about soil analysis, with on-site ground measurements of pollutants, satellite imagery, and predictive algorithms with Artificial Intelligence (AI) per site. It is being used for education, gamification, assessment and measuring project KPIs.

Multimedia tools will enable visualization for students and local stakeholders, enabling them to simulate the potential impacts of actions and understand specific NBS and processes. SPIRE iGIS is available at: https://spire.city/index.php/igis/

HUB: One of the central historical buildings in Baia Mare has been renovated and labelled as the SPIRE Hub and Maker Space. (1) The Hub is a public space open for meetings and other events, which will keep the SPIRE spirit alive and turn it into action. (2) The Maker Space is a creative place where 3D printers and CNC machines are made available for private use at prices that can be also covered by iLEU (s). A partnership with Transylvania College has been built, and the Association of Maramures Entrepreneurs use the ground floor of the building. SPIRE Hub information is available at: https://spire.city/index.php/spire-hub/

Metropolitan scale and Public Health: The Metropolitan Bio-based Strategy and Master Plan 2050 for Circular Communities is the primary tool to replicate and scale up SPIRE actions in the foreseen future. (1) Co-creation process led to the elaboration of a unique interventions´ matrix of interventions, aiming at making phytoremediation the new standard for GI management. (2) Surprizing solutions resulted, e.g., how to solve the issues of cyanide ponds and sterile landfills, ecological issues that phytoremediation cannot solve. (3) A phytoremediation calculator has been already used to estimate the time for restoring the soil to optimal quality. (4) SPIRE flexibility related to plant selection has created an NBS toolkit. Further information available: https://spire.city/index.php/project-deliverables/

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