SMURBS

SMart URBan Solutions for air quality, disasters and city growth

URBAN GROWTH

Component:

Urban growth

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Horizon 2020
Call: H2020-SC5-2015-one-stage
Topic: SC5-15-2015
Type of action: ERA-NET-Cofund
Grant agreement no: 689443
Proposal acronym: ERA-PLANET

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Context and motivation

The overall goal of Strand 1 pertains to identifying and facing cities' vulnerabilities, supporting policies to design strategies and procedures to shield citizens and mitigate impacts of urbanization.

Societal Benefit Areas (SBAs): SMURBS will provide solutions for sustainable urban development by exploiting EO for urban sprawl and LU/LC monitoring.

More work is needed for the interpretation of collected monitoring data, to produce policy-relevant indicators. In addition, the lack of a coherent system for reporting and collecting soil data from countries is reflected in the scarcity of harmonized soil data at the European level (EEA, 2016).

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Context and motivation

SMURBS supports the implementation of the Sustainable Development Goals (SDGs)and in particular goal number 11" Make cities and human settlements inclusive, safe, resilient and sustainable.

The specific SDGs indicators will be taken into account and integrated as far as possible into SMURBS outputs alongside new tailored indicators developed in WP4.

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UN SDGs

The recent adoption of the SDGs framework, along with its associated targets and indicators, has led to the acknowledgement of EO as an essential tool for their implementation by the global development community .

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Legal Framework

Calls for the sustainable use of land and soil in the **7th EAP** (EU, 2013), ongoing **CAP** reform in the 2014-2020 period, the EU **Biodiversity Strategy** to 2020 (EC, 2011b) and its mid-term review, the EU **Forest Strategy** (EC, 2013d), the **Territorial Agenda** of the European Union 2020 (EC, 2011d) and recent updates to the **Urban Agenda** for the EU (EU Ministers responsible for Urban Matters, 2016) and **Cork Declaration 2.0** for rural areas (EC, 2016a) evidence the attention of policymakers, scientists, economic stakeholders and civil society.

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Approach and expected outcome

The expected output is to create a portfolio of smart urban solutions, that will entail tools and solutions in support of urban planners, decision makers and urban ecologists, for a better understanding of the structure and the function of smart urban ecosystems under an urban ecology concept, where cities are represented as complex adaptive systems whose boundaries are not fixed but depend on the questions and pressures to be addressed.

Copernicus data and Core services exploitation ensures the uptake of Copernicus for the creation of the portfolio components. However, while LC monitoring relies mainly on CLMS products at the European level, at the regional/local level, higher spatial and temporal resolution products are required by policy makers (Munafò, Congedo, 2017).

Urban patterns recognition- understanding urbanization structures and patterns is a requirement for defining effective policies for limiting soil sealing and fostering sustainability of governance. Landcover maps allow for the assessment of urban dynamics through the calculation of landscape metrics that are measures describing the characteristics and patterns of landscape, in particular for studying landcover change in urban areas.

The identification and definition of urban development Evs and indicators (incl. SDGs relevant) and the development of the appropriate monitoring frameworks and protocols will be implemented.

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Consortium assets

The partners of the thematic area urban growth SRI, ROSA, AUTH and ISPRA contribute with their experience of using EO information for science purposes as well as for operational and policy support application. They are working with in-situ networks and remote sensing including urban monitoring from national to city scale.

Recently , ISPRA has developed a VHRL to identify built-up areas from RapidEye images (5m) and the assessment of the local urban indicators (ISPRA 2015). Within previous FP7-SPACE BIO_SOS project (www.biosos.eu) a knowledge-driven multi-scale, and mainly VHR EO data ECOPOTENTIAL project (www.ecopotential-project.eu/), the system, named EODESM, has evolved to include data driven classifiers, to be adopted according to data availability. The system is used for ecosystems (including urban) monitoring at multiple spatial and temporal scales (deliverable 4.2, www.ecopotential-project.eu/images/ecopotential/documents/D4.2.pdf).

This situation was overturned with the advent of Sentinel-1 twin satellites, offering 6-day revisit times at 20m spatial resolution. This sets a new era of the geodetic mapping of large cities.

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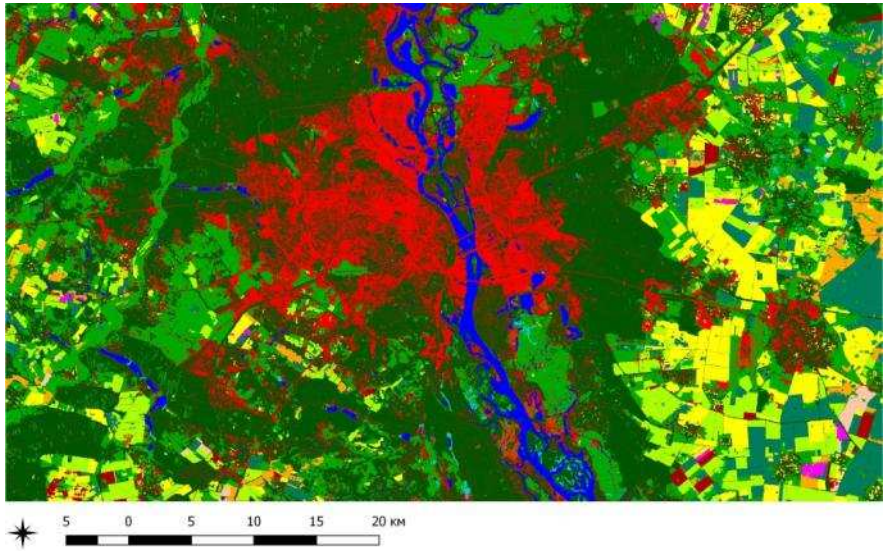
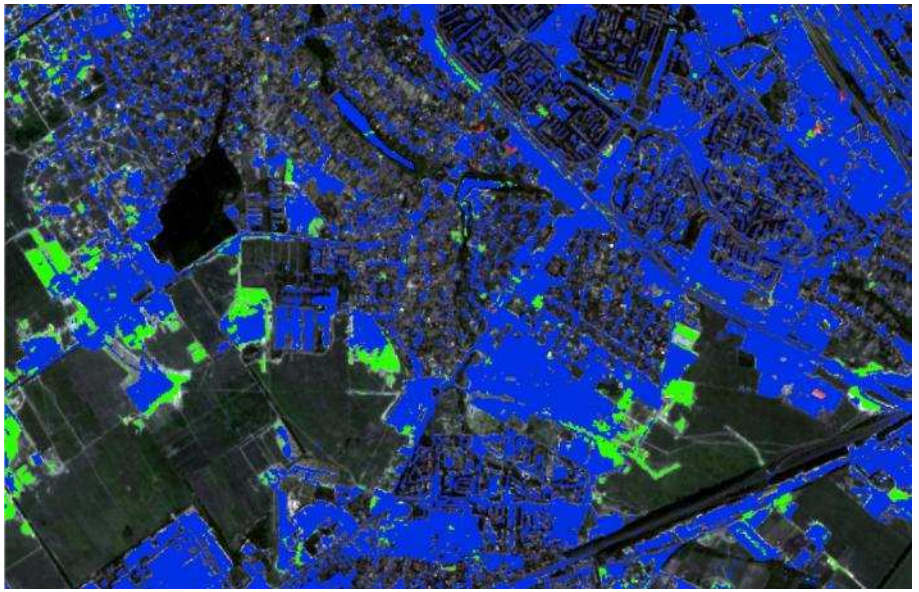
SRI expertise in urban landscape classification



Land cover classification and mapping, 2017, Kyiv 10 m



Urban growth 2016 (**blue**)-2017 (**green**)

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State-of-the-art: AUTH's Tools and Facilities

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OBSERVE: Strengthening & development of Earth Observation activities for the environment in the Balkan area

IASON: Fostering sustainability and uptake of research results through Networking activities in Black Sea & Mediterranean areas

LOCAL – SATS: Improving the local governance processes through exchange of good practices, pilots and training in geospatial technologies

EOPOWER: Earth Observation for Economic Empowerment

SAVEMEDCOASTS: Sea level rise scenarios along the Mediterranean coasts

FORCIP+: Forest Roads for Civil Protection

Demonstrating and promoting natural values in support of decision-making processes in Romania - N4D

MINISTERUL MEDIULUI

eea grants

Biodiversity and Ecosystems Services Programme

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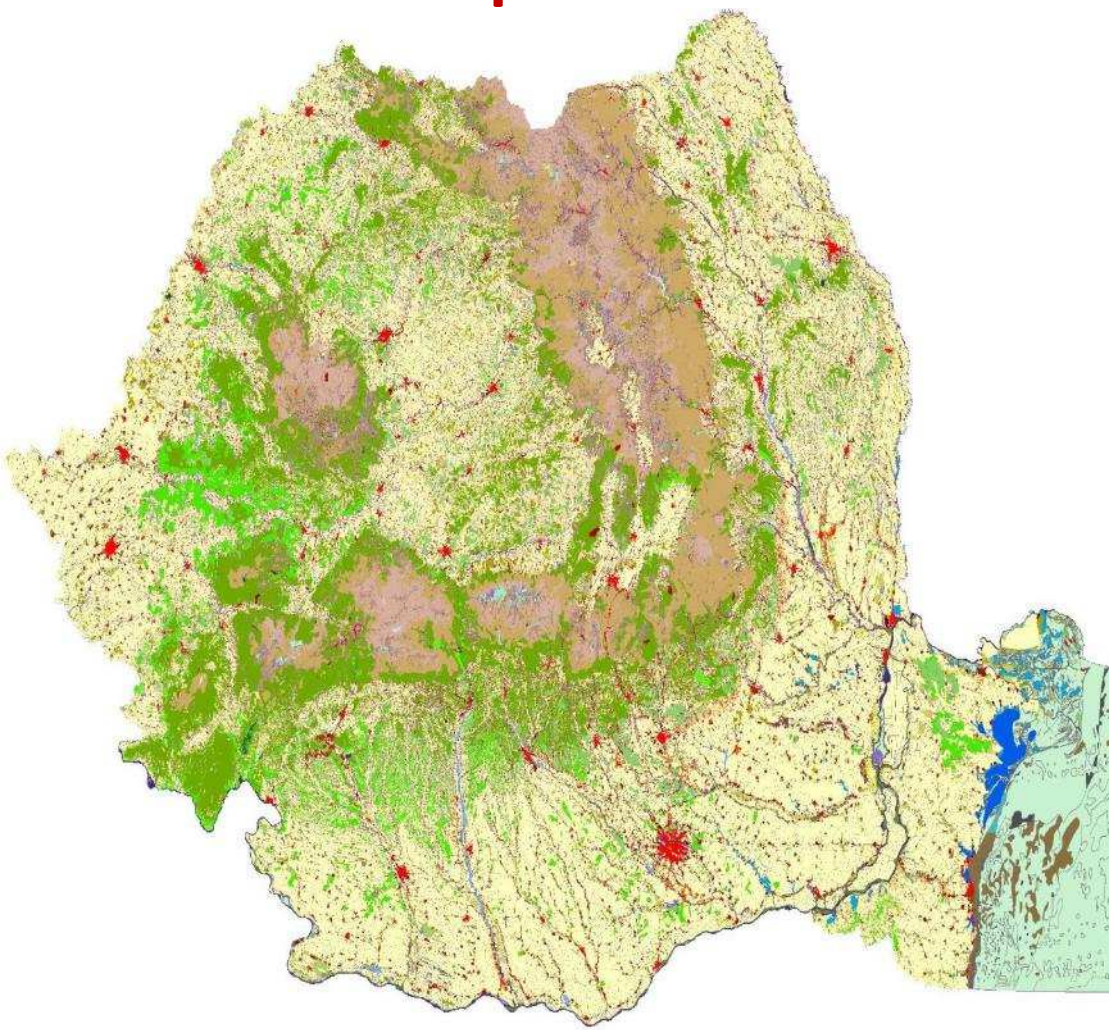
ROSA expertise

Demonstrating and promoting natural values in support of decision-making processes in Romania – N4D project

- Ecosystem mapping including urban
- Indicators of ecosystems services assessment
- Country-wide coverage



A2.2
A2.6
A3.7
A4.3
A5.6
A5.7
A6.9
B
C1.1
C1.2
C1.3
C1.5
C2.2
C2.3
C2.5
D
E
E1.9
E2.1
E2.5
E2.6
E2.7
E3.4
E3.5
E4
E4.3
E6.2
E7.2
Eiii-
F4.2
FB.4
G
G1.1
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G1.8
G1.A
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G4.C
H5.6
I1.1
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I1.5
J1.1
J1.7
J2.1
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Copernicus and Land Monitoring ISPRA

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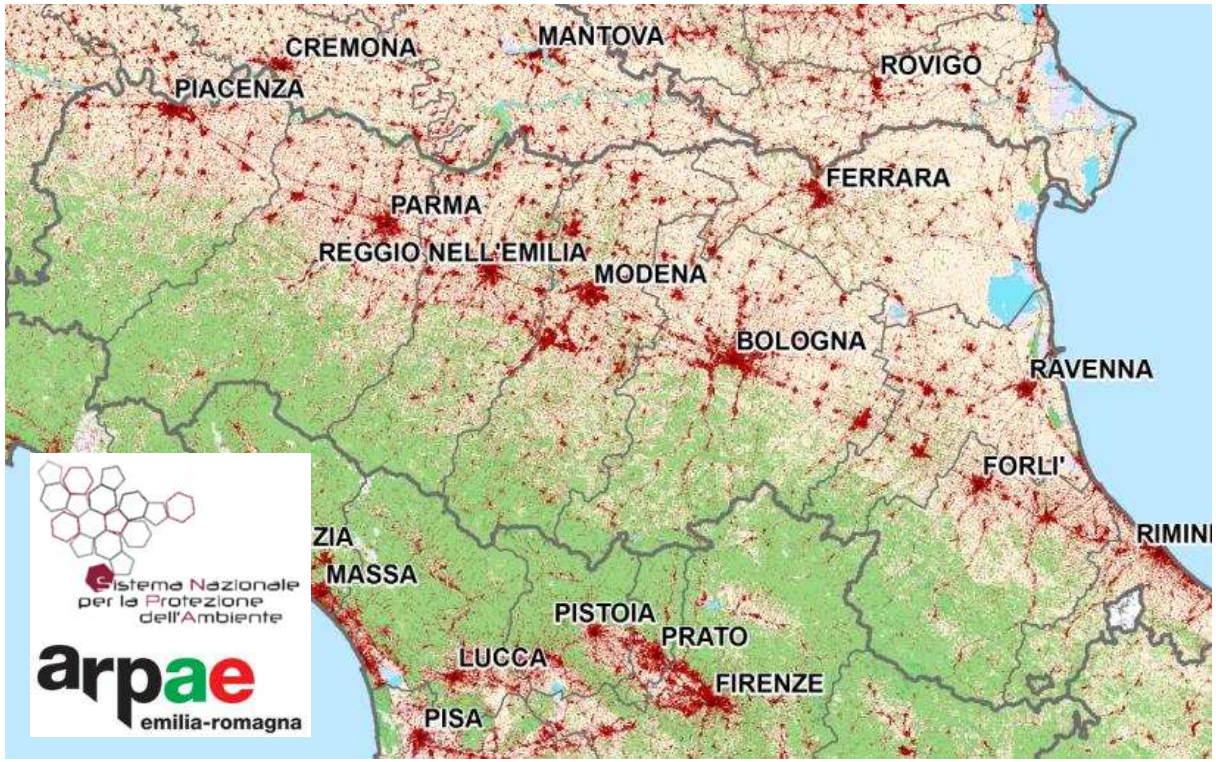
Copernicus EU map
20m x 20m

National map
10m x 10m (ISPRA)



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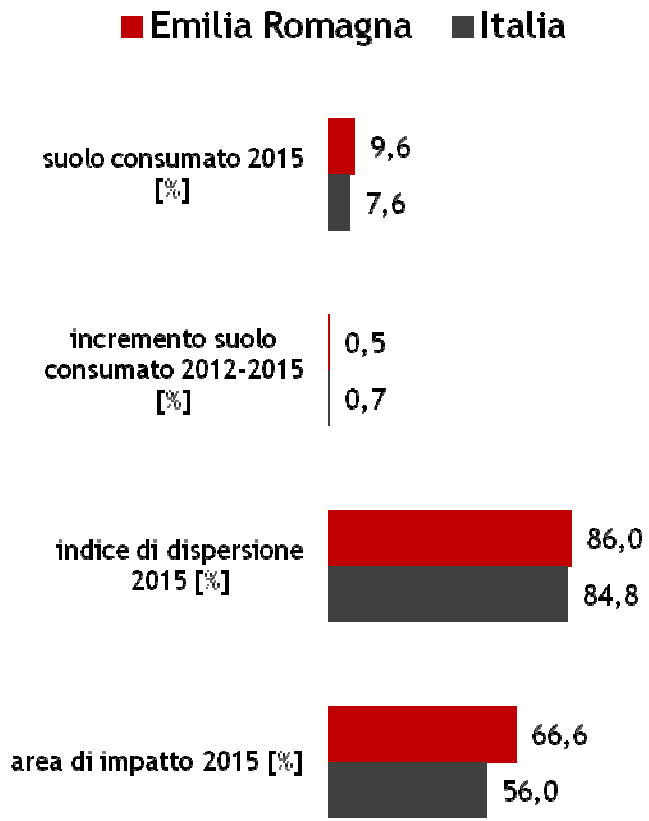
Land Monitoring ISPRA

Provincia	% 2015	km² 2015	Incremento % 2012-2015
Rimini	**12,9**	112	0,3
Reggio nell'Emilia	**12,1**	277	0,2
Modena	**11,5**	310	0,6
Ravenna	**10,2**	189	0,9
Parma	**9,3**	321	0,3
Piacenza	**9,0**	234	0,3
Bologna	**9,0**	332	0,7
Forlì-Cesena	**7,6**	182	0,5
Ferrara	**7,5**	198	0,7



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State-of-the-art: tools

Remote sensing techniques: SMURBS is using the unique European asset of the Copernicus Sentinel family of satellites , such as **Sentinel 1 and 2** , designed to provide HR images. In particular the visible and near infrared bands with a 10m resolution are useful for urban mapping.

Land cover classification: semi automatic classifications are very useful techniques for the identification of land cover based on class foreknowledge of the **spectral signatures**. Several algorithms , that are used for the accurate identification of land cover classes, will be analysed and assessed within SMURBS and adapted to meet the mapping needs of large cities.

Calculation of landscape metrics that describe the characteristics of landscape patches regarding the structure, function and changes for assessing the land cover change in urban areas.

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State-of-the-art: city examples

The city of **Turin** organized "Innova.TO", a competition for all municipal employees of Turin, except the directors, inspired by the principles of lean organisation. It aims to stimulate and develop innovative projects to improve the administration's performance, reducing waste and/or valuing resources. One of the winning proposals was "Smart solutions for smart procurements". The project encompasses the definition of a new organisational model and dedicated administrative instruments to systematise the use of innovation's procurement and **realise Smart City policies**. The project proposes the **installation of sensors to regulate the intensity of the light in the public buildings** and, consequently, save energy consumptions.

The City of **Bologna**, within the framework of the EU Life+ Project BLUEAP (Bologna Local Urban Adaptation Plan for a resilient city), identified and analysed risks, hazards and main vulnerabilities related to climate change, water scarcity, heat waves, extreme weather events. Drawing on its local vulnerabilities, Bologna's Adaptation Plan in 2015 outlined the strategy and actions in the **management of green space and water** by the different levels of government in the territory. The Plan consists of a local strategy and an Action Plan that translates these strategies into measures. Strategy and Plan make reference to a medium-term time frame until 2025. In the light of the plan a package of integrated pilot actions has been launched: drinking water saving and water treatment, collection and storage of rainwater, targeted use of plant species to improve the microclimate and reduce air pollution, pre-emptive insurance against risks. The plan was the final step of a participatory process which started with a **study of the urban area in terms of ecosystems, population, population distribution and census, production activities, natural resources and of its main vulnerabilities related to climate change**. The process continued with the ranking of potential risks and with stakeholder engagement to define actions for the Climate Adaptation Plan.

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Progress beyond the state-of-the-art

SMURBS ambition is to overcome the currently fragmented status of EO under the common banner of the "**smart city concept**".

To guarantee the sustainability of an **annually updated system** of urban growth monitoring and assessment at city level, SMURBS will use satellite data integrated with ancillary information. In this way, reliable maps and indicators to sustain decision making processes will be obtained, to support institutional activities of public administration at different levels and help to evaluate environmental impacts and plan activities for the development of urban, agricultural and natural areas.

On the local scale, the availability of VHR images will be crucial for the analyses needed within urban areas. SMURBS, will further develop the EODESM system for providing not only LC but also LU maps as well as urban downstream services, as variables and indicators. The system will address the concepts of the new object-oriented FAO taxonomy, named as LCML with further development in LCHML, to provide not only LC but also LU information according to user needs. It will include class specific context-sensitive features to differentiate LC classes into LU categories.

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How SMURBS will push forward context: city examples

Bari will act as a case study of urban growth and migration tackled by satellites

Bucharest will represent a test bed for AQ modeling and satellite solutions for disasters and urban growth

Kyiv a pilot city , tackles AQ with satellites , in-situ and modeling, disasters with satellites, modeling and Cos and urban growth with satellites.

Five municipalities from the Italian Regions, Emilia Romagna, Campania, Friuli Venezia Giulia, Veneto and Puglia will serve as test beds for satellite driven solutions on urban growth.

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Tangible outcomes - Deliverables

D 4.3: compilation of “urban growth” products:

Report on convergence strategy, identification of synergies, specifications (M12), to be refined until M27 to take up pilots experiences and the stakeholder workshop.

Report on urban development indicators from statistical data, and satellite images for land cover and land use monitoring, with the emphasis for urban growth, urban density and sprawl, green areas within cities and ecosystems.

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"Take-home" message

The continuing urbanization and uncontrolled growth of cities increases the demographic and environmental pressures and therefore also the fragility - vulnerability to natural disasters, at the same time city administrations suffer the financial pressures and need to "do more with less" and the economic pressures by increased competition between cities.

City administrations must find novel, efficient and economic approaches to governance to address the development challenges of the infrastructures and the services needed to ensure peoples' wellbeing, economic development of cities and environmental protection. Smart technologies offer exciting possibilities for new services provision, integrated city infrastructures, innovation potential and sustainable city development. In this aspect, EO are an excellent asset, promoting welfare and shared prosperity for all levels of human settlements, informed urban planning and rethinking of the Urban Agenda.

SMURBS promotes and coordinates this "smart city" approach into a European network of cities.

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