		ENVRI-FAIR (Maria Johnsson, Maggie Hellström, Barbara Magagna, Ari Asmi)	EOSC-Life (Susanna Assunta Sansone, standing in as rep)	ESCAPE (Mark Allen, Kay Graf)	PaNOSC (Ornela de Giacomo)	SSHOC (Erzsébet Toth-Czifra, Laure Barbot)
11 May Pillar 1: Concepts for FAIR implementation						
Concepts for FAIR implementation (Pillar 1)	Rec. 1: define FAIR for implementation	We have a task dedicated to FAIR assessment of Research Infrastructures. For these tasks we run three assessment rounds, one in the first year, one at the end of the second year and one at the beginning of the fourth year. We applied a landscaping method we developed together with GO FAIR, called the FAIR Implementation Profiles (FIP). The first run with a pre-version of the FIP approach is documented in a deliverable of WP5: Magagna, Barbara, Adamaki, Angeliki, Liao, Xiaofeng, Rabissoni, Riccardo, & Zhao, Zhiming. (2020). ENVRI-FAIR D5.1 Requirement analysis, technology review and gap analysis of environmental RIs (Version 1). https://doi.org/10.5281/zenodo.3884998 The FIP approach is described in Schultes E., Magagna B., Hettne		ESCAPE Data Management Plan (D1.3): https://projectescape.eu/deliverables-and-reports/d13-escape-data-management-plan ; Deliverable D4.2 of the ESCAPE project: https://projectescape.eu/deliverables-and-reports/d42-intermediate-analysis-report-use-ivoa-standards-fair-esfri-and	Photon and Neutron Data policy update for FAIR D2.1 (May 2020) Common API for metadata catalogues D3.1 API definition D3.5 NeXus Metadata mapping schema and proposed new definitions.	The "The FAIR Guiding Principles for scientific data management and stewardship" by Wilkinson et al is followed in terms of definitions and implementation guidelines. Keeping in mind the internal diversity in SSH, specific (data) communities addressing/translating what FAIRification would mean for them. SSHOC examples (described in details in D1.6 SSHOC Data Management Plan - https://doi.org/10.5281/zenodo.3931490 - next iteration of the SSHOC DMP will also provide a FAIR overview for all SSHOC data sets): - survey data - case studies and pilots data - Tools and services data - SSHOC Marketplace data - SSHOC user communities data communities (ethnic and migration studies, electoral

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	K.M., Pergl R., Suchánek M., Kuhn T. (2020) Reusable FAIR Implementation Profiles as Accelerators of FAIR Convergence. In: Grossmann G., Ram S. (eds) Advances in Conceptual Modeling. ER 2020. Lecture Notes in Computer Science, vol 12584. Springer, Cham. https://doi.org/10.1007/978-3-030-65847-2_13 General aspects of FAIRness, Openness and related policies are a key part of the whole ENVRI-FAIR concept, as described in Petzold, Andreas; Asmi, Ari; Vermeulen, Alex; Pappalardo, Gelsomina; Bailo, Daniele; Schaap, Dick; M. Glaves, Helen; Bundke, Ulrich; Zhao, Zhiming: ENVRI-FAIR – Interoperable environmental FAIR data and services for society, innovation and research, IEEE International Conference on eScience 2019 (eScience2019), San Diego, 24-27, Oct 2019, http://doi.org/10.1109/eScience.2019.00038				studies, Heritage Science and Humanities datasets, "Historical high quality company level data for Europe" design study. For a generic data policy statement, see SSHOC - Position paper 2020 https://zenodo.org/record/3697121#.Xrp8dplS_b0
Rec. 2: Imple	We have a project Task Force on identification and types, which is looking to map out current		This document reports an initial version of the analysis of the use of	Common catalouge API implimentation report D3.4 Policy	In the context of SSHOC Virtual Collection Registry In the context of the SSHOC

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ment a model for FAIR digital objects	practices for PIDcuse in ENVRI-FAIR members, with a view to update the Best Practices forcidentification and citation that arose from the ENVRIplus project, see e.g.cChapter 8 in M. Hellström et al., Acsystem design for data identifier and citation services for environmental RIs projects to prepare an ENVRIPLUS strategy to negotiate with externalcorganisations. ENVRIplus Deliverable D6.1, submitted on January 31, 2017.Available at https://www.envriplus.eu/wp-content/uploads/2015/08/cccD6.1-A-system-design-for-data-identifier-and-citation-services-for-environmental-RIs.pdf The ENVRI-FAIR PID Task Force is also following the discussions on-going in e.g. RDA and at EOSC level on what is required to support FAIR Digital Objectsthroughout the research data lifecycle, The Task Forces are described in Adamaki, Angeliki, & Vermeulen, Alex. (2020). ENVRI-FAIR D5.2: Implementation plan for common development goals (Version 1). Zenodo.		IVOA standards for FAIR ESFRI and community data. The analysis is performed in the framework of Task 4.2 “Implementation of the FAIR principles for ESFRI data through the Virtual Observatory” of ESCAPE Work Package 4 “Connecting ESFRI projects to EOSC through VO framework” (CEVO).	implimentaion guidlines defiend D2.3 Deliverable 5.1: Prototype simulation data formats as openPMD domain specific extensions including example datasets.	Open Marketplace, D.7.1. (System Specification - SSH Open Marketplace) presents an implementation plan for FAIR digital objects, Oct 2019, https://doi.org/10.5281/zenodo.3547648

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	https://doi.org/10.5281/zenodo.4061701 [1] During 2020, we actively participated in the common PID Task Force set up by the EOSC Executive Board FAIR and Architecture Working Groups, and contributed to the two reports “A Persistent Identifier (PID) policy for the European Open Science Cloud” (https://doi.org/10.2777/926037) and “PID architecture for the EOSC” (https://doi.org/10.2777/525581).Starting in 2021, ENVRI-FAIR is also represented (via DiSSCO and ICOS) in the FAIR Digital Object Forum initiative (https://fairdo.org); of particular relevance to Rec. 2 are the FDO-BIG (Basic Infrastructure Group), FDO-CWFR (Canonical Workflows for Research) and FDO-TSIG (Technical Specification & Implementation Group) working groups.In addition, individuals working for ENVRI-FAIR member organisations have been engaging with relevant Research Data Alliance groups, including the Data Fabric Interest Group (https://www.rd-alliance.org/group/data-fabric-				

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	ig.html). Since 2020, DFIG is concentrating its work on implementing technologies and strategies towards creating systems that allow machine actionable management and processing of FAIR Digital Objects.Regarding relevant training, ENVRI-FAIR WP6 is developing curricula and materials, as well as hosting events to promote the application of relevant RDM technologies in the project member organisations as well as the wider ENVRI Community. An overview of the topics covered is given in the newsletter post “A report on ENVRI partner FAIRness training, its gap analysis & future plans” https://envri.eu/wp-content/uploads/2020/01/Maggie.pdf and a list of training activities is provided at https://envri.eu/training/				
Rec. 3: develop components of a FAIR	For Actions 3.1 and 3.2: ENVRI-FAIR is creating the open access ENVRI-hub for delivering environmental data and services through the EOSC. Architecture and functionalities of the ENVRI-hub will be driven by the applications, use cases and user	Several FAIR components released, described in this report: https://www.eosc-life.eu/wp-content/uploads/2021/03/eosc-life-achievements-	D4.2 ESCAPE: https://projectescape.eu/deliverables-and-reports/d42-intermediate-analysis-report-use-ivoa-standards-fair-esfri-and This document reports an initial version of the	WP 3 Common API to deliver interoperable search between facility meta data catalouges. WP4 Development of data analysis service infrastrure. WP8	WP3- FAIR SSH CItation Service Prototype - https://www.sshopencloud.eu/making-data-findable-being-citable-tools- the SSH Conversion Hub provides an inventory of solutions for conversions between data and

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ecosystem	needs, and will be based on three main pillars: (1) the ENVRI Knowledge Base as a Wiki-based resourcefor knowledge, services and assets; (2) the ENVRI Catalogue as machine-actionable interface to the ENVRI ecosystem; and (3) subdomain and cross-domain use cases as demonstrators for the capabilities of service provision among ENVRIs and across Science Clusters. The ENVRI-hub is intended to act as a key platform for users and developers planning to include ENVRI services in their workflows through EOSC resources. Its implementation will support the ingestion of the environmental science community into EOSC with their specific userrequirements and experiences. The ENVRI-hub demonstrator will be released at the end of the project, December 2022.The Task Forces are described in: Adamaki, Angeliki, & Vermeulen, Alex. (2020). ENVRI-FAIR D5.2: Implementation plan for common development goals (Version 1). Zenodo. https://doi.org/10.5281/zenodo.4	brochure-Final.pdf Also here is a EOSC-Life collection in FAIRsharing that represents more then 100 diverse data resources/repositories produced by EOSCLife partners (https://fairsharing.org/collection/EOSCLife); here is the graphical relationships between standards used by these repositories 9https://fairsharing.org/graph/#/collection/bsg-c000077).Here a crosswalk of most used metadata schemes and guidelines for metadata interoperability: https://fairsharing.org/collection/CrosswalkOfMostUsedMetadataSchemesAndGuidelines	analysis of the use of IVOA standards for FAIR ESFRI and community data. The analysis is performed in the framework of Task 4.2 “Implementation of the FAIR principles for ESFRI data through the Virtual Observatory” of ESCAPE Work Package 4 “Connecting ESFRI projects to EOSC through VO framework” (CEVO).	Training tools for EOSC & FAIR data for P&N	file formats - https://www.sshopencloud.eu/interoperability-hub- SSHOC Virtual Collection Registry - https://sshopencloud.eu/sshoc-virtual-collection-registry - SSHOC Switchboard - https://sshopencloud.eu/sshoc-switchboard- WP4- Survey specific parallel corpora. Multilingual Corpus of Survey Questionnaires - https://sshopencloud.eu/survey-specific-parallel-corpora-multilingual-corpus-survey-questionnaires - Aïoli platform - https://sshopencloud.eu/a%C3%AFoli-platform- Web Panel Sample Service (WPSS) - https://sshopencloud.eu/ready-use-sample-management-system-web-panel-sample-system-wpss- Automatic Verification Tool (AVT) - https://sshopencloud.eu/automated-verification-toolWP5- ARIADNEplus- ADS Guides to Good Practice- Repository service for SSH - https://sshopencloud.eu/ssh-data-repository-service-eosc- New ESS data repositoryWP6- Training Professionals Network

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		061701 [1] WP4 Common FAIR Policies D4.1 Organisation of PWG – Membership, procedures for operation https://doi.org/10.5281/zenodo.3885034 And D4.2 Policy Landscape in the ENVRI-FAIRdomain, https://doi.org/10.5281/zenodo.3961475WP5 – Common requirements and testbed for (meta)data services, community standards and cataloguingD5.1 Requirement analysis, technology review and gap analysis of environmental research infrastructures, https://doi.org/10.5281/zenodo.3884998				- https://sshopencloud.eu/training-professionals-network- SSHOC Train-the-trainer toolkit: https://sshopencloud.eu/sshoc-train-trainer-toolkit WP7D7.1 System Specification - SSH Open Marketplace https://sshopencloud.eu/d71-system-specification-ssh-open-marketplace WP9For further examples: see tools and services presented in the SSHOC catalogue: https://www.sshopencloud.eu/service-catalogue
	Rec. 16: Apply FAIR broadly	Currently, the ENVRI community are harmonizing their policies for FAIR Data provision, via a Policy Working Group.In addition, there are work done in the specific task forces and subdomain work packages: The Guidelines for infrastructure policies are a part of WP4 of ENVRI-FAIR, and currently being developed together with aformalized Policy Framework. This will capture most of the RI policies needed for Actions 16.2 and 16.3.The four scientific subdomains of	RMDkit by ELIXIR-Converge: https://rdmkit.elixir-europe.org/FAIR cookbook by IMI FAIRplus (ELIXIR Nodes and pharmas): https://fairplus.github.io/the-fair-cookbook/content/home.html	FAIR science products are a central part of the ESCAPE services.	All WP aim to develop caapbility that allows phonon and neutron facilities to apply fair principles to their data chain. With a common approcah across each domain. Data policy work and update to metadata schema WP2 & Wp3 are directly relevent to faciltating the applocation of FAIR principles	D6.1 SSHOC Community Engagement Strategy, https://doi.org/10.5281/zenodo.3592243 There will be SSHOC webinars with LIBER and Trust-IT on 19 May about FAIRIfication in the scholix framework, https://sshopencloud.eu/training Ensuring broad application of FAIR: DARIAH Research Data Management WG (https://www.dariah.eu/activities/working-groups/research-data-management/) Future

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	ENVRI-FAIR (atmosphere, marine, solid earth and biodiversity/ecosystems) haveperformed their own analyses of which research data management-related components and technologies are required to make their respective data FAIR forboth humans and machines, and how to implement those RDM components that are not yet in place. The resulting implementation plans are found in thedeliverables: ● Fiebig, Markus, Lund Myhre, Cathrine, Boulanger, Damien, Rivier, Leonard, Vermeulen, Alex, Häggström,Ingemar, … Tukiainen, Simo. (2020). ENVRI-FAIR D8.3 Atmospheric subdomain implementation plan (Version 1). Zenodo. https://doi.org/10.5281/zenodo.388524 ● Thijsse, Peter, Schaap, Dick, Exter, Katrina, Vermeulen, Alex, Pfeil, Benjamin, Carval, Thierry, … Rodero, Ivan. (2019). ENVRI-FAIR D9.2 Marine subdomain implementation plan (Version 1).Zenodo. https://doi.org/10.5281/zenodo.3885327				plans: establishing stronger ties with the cultural heritage sector as they are important partners in humanities data workflows providing source materials for their work.

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	● Bailo, Daniele, Jeffery, Keith, Trani, Luca, Roquencourt, Jean-Baptiste, Langeland, Tor, Rodero, Ivan, &Manunta, Michele. (2020). ENVRI-FAIR D10.2: Roadmap for implementation of FAIR concepts (Version 1). Zenodo. https://doi.org/10.5281/zenodo.3925503 ● Papale, Dario. (2020). ENVRI-FAIR D11.1 Biodiversity and Ecosystem subdomain implementation short term plan (Version 1). Zenodo. https://doi.org/10.5281/zenodo.3885361 As part of their implementation work, subdomains have defined use cases which will highlight and demonstrate how ENVRIs (also external to ENVRI-FAIR) can adopt technologies and best practices to enhance the FAIRness of their data services. Some of these use cases are described in the deliverables listed above, with additional examples providedin:● Rivier, Leonard, Lund Myhre, Cathrine, Boulanger, Damien, Fiebig, Markus, Ferrighi, Lara, Tarniewicz,Jerome, & Tjulin, Anders. (2020). ENVRI-FAIR				

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	D8.2 Recommended scientific end-to-end demonstration services (Version 1).Zenodo. https://doi.org/10.5281/zenodo.3885226 ● Carval, Thierry, Thijsse, Peter, Portier, Marc, Exter, Katrina, Pfeil, Benjamin, Pouliquen, Sylvie, …Harscoat, Valérie. (2021). ENVRI-FAIRD9.6: Marine subdomain EOV product specification (Version 1). Zenodo. https://doi.org/10.5281/zenodo.4766796 ● Jeffery, Keith, Bailo, Daniele, Rocquencourt, Jean-Baptiste, Langeland, Tor, Spinuso, Alessandro, Trani, Luca,… Rodero, Ivan. (2020). ENVRI-FAIR D10.4: Report on Implementation Activities (Version 1). Zenodo. https://doi.org/10.5281/zenodo.4418953 ● de Natale, Flora, Bossi, Monique, Chanzy, Andre, de Nart, Dario, de Pascalis, Francesca, Ferrighi, Lara, … Basset, Alberto. (2021). ENVRI-FAIR D11.2: Report on FAIRness implementation activities in the Biodiversity and Ecosystem subdomain (Version				

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		1). Zenodo. https://doi.org/10.5281/zenodo.4682826				
	Rec. 17: Align and harmonise FAIR and Open data policy	ENVRI FAIR has a number of activities for this development. Policy framework work on WP4 is works to harmonize most of the indicated policies. The work is ongoing, but current situation can be seen at: WP4 Common FAIR Policies: D4.2 Policy landscape in ENVRI domain https://doi.org/10.5281/zenodo.3961475. Additional work is on the strategy of ENVRI community, which positions the work of the community towards similar goals: WP3 Strategy for alignment with national and international stakeholders, community development and innovationactivities. "ENVRI-FAIR EOSC Position Paper", https://doi.org/10.5281/zenodo.3666805 Upcoming documents:D4.5 Updated policy landscape in ENVRI domain, July 2021D4.6 Draft policy document for common service catalogue, September 2021D4.7 Policies for common service catalogue, policy landscape in EOSC domain, July 2022MS12 Strategy			Data policy update as apart of WP2 D2.1	SSHOC - Position paper 2020 https://zenodo.org/record/3697121 - .Xrp8dplS_b0

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		for common policy development, internal reportMS13 Final policy document agreed in the PWG, May 2022				
19 May Pillar 2: FAIR culture						
	Rec. 4: Develop interoperability frameworks	Members of ENVRI-FAIR initiated the RDA InteroperAble Descriptions of Observable Property Terminology (I-ADOPT) WG as co-chairs to develop an Interoperability Framework for representing and describing variables. The Variable describes WHAT has been observed, measured, simulated or calculated independently of WHERE, HOW and WHEN the data acquisition has taken place. This makes the application of this concept reusable in different settings giving meaning to the value provided. The construction of the framework has been informed by a review of current practices used in the community. The working group is also iteratively testing and refining the framework through a set of in-depth use cases. Much like a generic blueprint, the refined conceptual framework will be a basis upon which terminology	Via EOSC-Life and under ISO ISO/TC 276 a collection of formats, schemas and models for data and metadata is being developed (the ISO/CD 20691 specification, also available as an ISO FAIRsharing Collection). In FAIRplus, frameworks and processes are being developed to make and keep data FAIR in the life and biomedical sciences, using a number of datasets ranging from omics to clinical. https://fairplus-project.eu/making-fair	ESCAPE WP4 is connecting the ESFRI to the EOSC using the Virtual Observatory interoperability framework. An first deliverablee, ESCAPE D4.2 the "INTERMEDIATE ANALYSIS REPORT ON USE OF IVOA STANDARDS FOR FAIR ESFRI AND COMMUNITY DATA" was produced March 2020. A final report will bee done near the end of the project (May 2022) ESCAPE D4.8 the "Final analysis report on use of IVOA standards for FAIR ESFRI and community data and best stewardship practices for value-added data"	Common interoparable api for meta data catalouges. Common remote services for data analysis	WP3 Interoperability Hub D3.1 Report on SSHOC (meta-) data interoperability problems https://doi.org/10.5281/zenodo.3569868 SSHOC Reference Ontology and the mapping done with selected SSH standards (D4.19 and MS20) D7.3 Marketplace interoperability to be published on December 2021.

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	developers can formulate or refine their local design patterns, in alignment with others. With these, they may leverage their local resources in a collective attempt to represent complex properties observed across the environmental sciences (from marine, atmospheric, and terrestrial Earthsciences, as well as biodiversity). See: https://www.rd-alliance.org/groups/interoperable-descriptions-observable-property-terminology-wg-i-adopt-wg , for more details the wiki page of the RDA WG, which is kept up to date on the continuous improvements of the framework.				
Rec. 5: Ensure data management via DMPs	Although DMPs are not in the center, the work on the ENVRI-FAIR WP4 on policy harmonization touches on the issue. (e.g. D4.2 Policy landscape in ENVRI domain https://doi.org/10.5281/zenodo.3961475) **Updated**		ESFRIs have high level data management plans that are integrated into their operations, and under their responsibility. At a different level, projects and researchers are being required to specify a DMP in research proposals. ESCAPE WP4 is promoting certification of repositories	DMP template for facilities will be developed in WP2 D2.2	Countinouos support via trainings: SSHOC D6.9 SSHOC Trainer Toolkit (draft) , SSHOC-DARIAH Train-the-Trainer Research Data Management Bootcamp (https://dariahopen.hypotheses.org/1021) D6.7 Inventory of existing learning materials **Updated**

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Rec. 6: recognise & reward FAIR data & stewardship	The work plan for ENVRI-FAIR does not per se include actions on developing policy and practice for assigning credit related to making data and services FAIR, but the issues covered by this Recommendation are very important to the ENVRI Community member organisations and their respective staff. Those ENVRI-FAIR partners that operate repositories have an important responsibility for ensuring that correct credit is given to all involved in the data production and curation processes, as well as promoting best practices for citation to their respective designated communities. In addition, ENVRI-FAIR's Task Force 5 is concerned with formulating and promoting best practices for data product licensing, data citation and summarizing of statistics for data usage and impact will help both individuals and institutes involved in producing data to extract reliable input for CVs and activity reports.		(CoreTrustSeal) to raise awareness. A report will be done near the end of the project (May 2022) ESCAPE D4.8 the "Final analysis report on use of IVOA standards for FAIR ESFRI and community data and best stewardship practices for value-added data". It should include some consideration of recognition of data stewardship.		WP6 "Fostering Communities, Empowering Users, & Building Expertise" and esp. D6.9 SSHOC train-the-trainer toolkit and the Training Toolkit: https://training-toolkit.sshopencloud.eu/ ; Contributions to community curation in the SSHOC Open Marketplace will be appropriately rewarded. https://dariahopen.hypotheses.org/834

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	Rec. 18: Cost data management	The work plan of ENVRI-FAIR does not cover this topic.				Cost estimations could be provided by the SSHOC affiliated repositories.
	Rec. 19: Select and prioritise FAIR digital objects	The work plan of ENVRI-FAIR does not cover this topic as such. However, as pointed out in Action 19.2, observational data collected (in the field) by environmental or Earth science research initiatives are unique, as they represent the state of a given point in space and time that cannot be reproduced.				n/a
	Rec. 20: Deposit in Trusted Digital Repositories	We note that while there is no specific activity on this in ENVRI-FAIR, many of the project partners that are hosting their own data repositories are actively seeking Core Trust Seal certification - several via the FAIRsFAIR support programme. Indeed, RIs that produce and/or manage environmental and climate data are keenly aware of the need to store their data and metadata in a trustable manner, ensuring both security and transparency of their holdings.		Development of trusted digitial repositories: DIOS (Data Lake): D2.1 and OSSR (Software Catalogue): D3.1 https://projectescape.eu/deliverables-and-reports/d31-project-plan-wp3-ossr and https://projectescape.eu/deliverables-and-reports/d21-implementation-plan-and-design-pilot **Updated**	Development of common meta data catalouge API and implimentation report from facilities. (Could include work towards trusetd certification)	SSHOC certification support https://www.sshopencloud.eu/sshoc-certification-support

		ENVRI-FAIR (Maria Johnsson, Maggie Hellström, Barbara Magagna, Ari Asmi)	EOSC-Life (Susanna Assunta Sansone, standing in as rep)	ESCAPE (Mark Allen, Kay Graf)	PaNOSC (Ornela de Giacomo)	SSHOC (Erzsébet Toth-Czifra, Laure Barbot)
	Rec. 21: Incentivise reuse of FAIR outputs	Providing the ENVRI-hub to advertise and make the ENVRI Community's FAIR data products and services easy to discover and use - both for research and innovation - as well as facilitating comprehensive statistics of usage.Training and outreach activities at a subdomain level (via e.g. conferences and other channels) to inform and educate end user communities on how to leverage FAIR data as inputs to their research, and how to make their outputs FAIR in their turn.				TBD at a later stage of the project lifecycle.
20 May Pillar 3: FAIR Ecosystem						
FAIR ecosystem (Pillar 3)	Rec. 7: support semantic technologies	There has been quite a lot of discussions around semantic technologies in ENVRI-FAIR, such as vocabularies and ontologies. WP5 and WP7 are working on semantics in different ways, both versus the subdomains and versus RI:s. A webinar series on data provenance, covering semantics, was organized from December 2020 until January 2021, see: https://training.envri.eu/course/view.php?id=47 Semantic Web, ontologies and related topics have also featured prominently in summer & winter		ESCAPE is supporting the use and development of IVOA Semantics standards as part of general support of IVOA standards for Astronomy/Astroparticle ESFRIs	Update to metadata mapping schema D3.5 (Tobias Richter Tobias.Richter@ess.eu might be the PaNOSC contact for further details of the PaNOSC work in this area)	D9.7 Design of Knowledge Graph (election studies and semantic technologies) D4.7 SSHOCro beta version T5.2 Dataverse Semantic Gateway T4.6 Semantic annotation of Heritage Science Data

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	schools co-organized in 2018-2021 by the ENVRI Community and LifeWatch ERIC. Members of ENVRI FAIR are contributing to a paper series on guidelines about FAIR vocabularies. See: a pre-print of the first paper: Cox SJD, Gonzales-Beltran A., Magagna B., Marinescu M.C. Ten Simple Rules for making a vocabulary FAIR.2021, http://arxiv.org/abs/2012.02325 and https://fairvocabularies.github.io/examples . Several ENVRI Community RIs (EPOS, DiSSCo, LifeWatch, ICOS) contributed to the SEMAF project[1] [2] with their insights on their use of semantics-related concepts and technologies and how these can support a flexible semantic framework (i.e. through mapping and cross-walks), see the report Broeder, Daan, Budroni, Paolo, Degl'Innocenti, Emiliano, Le Franc, Yann, Hugo, Wim, Jeffery, Keith, … Zwolf, Carlo Maria. (2021, March 31). SEMAF: A Proposal for a Flexible Semantic Mapping Framework (Version 1.0). Zenodo.				

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	http://doi.org/10.5281/zenodo.4651421				
Rec. 8: Facilitate automated processing	WP7 Common Implementation and Support provides effective consultancy and support for the FAIR development and technology transfer activities within individual RIs, adopting or customizing the existing technologies and investigating reusable solutions for common problems that emerge at the cluster and individual RI levels. [1] [2] One key outcome is the ENVRI-Knowledge Base which connects to the FAIR dashboard. This platform collects processing			WP4 developmnet of data analysis services WP5 development of simulation serviecs	T3.6 Making Data Re-usable and Actionable

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	demonstrators developed by ENVRI Research Infrastructures for implementing specific FAIR dataprinciples (e.g. for provenance and for vocabularies). ENVRIplus had a dedicated task on data provenance which output (recommendations and a provenancetemplate system) is documented in: Magagna B., Goldfarb D., Martin P., Atkinson M., Koulouzis S., Zhao Z. (2020) Data Provenance. In: Zhao Z., Hellström M.(eds) Towards Interoperable Research Infrastructures for Environmental and Earth Sciences. Lecture Notes in Computer Science, vol 12003. Springer, Cham. https://doi.org/10.1007/978-3-030-52829-4_12 . isthis ok, or more?				
Rec. 9: Certify FAIR services	WP5 Common requirements and testbed for (meta)data services, community standards and cataloguing, WP7 Common implementation and support. Individual RI:s are working on repository certification (CTS), for example ICOS, LifeWatch, IAGOS, EMSO, AnaEE, EISCAT.	ELIXIR has a formal selection process for Core Data Resources (https://elixir-europe.org/platforms/data/core-data-resources) and Recommended Interoperability Resources (https://elixir-	Awareness of CoreTrustSeal certification is being supported by ESCAPE in WP4, and this topic will be included in the dliverable D4.8 "Final analysis report on use of IVOA standards for FAIR ESFRI and community data and best	Self evaluation of data policy implimentation against RDA	T8.2 supports SSH repositories in achieving CoreTrustSeal certification. D8.2 Certification plan for SSHOC repositories, https://doi.org/10.5281/zenodo.3725867 . Support program includes 14 repositories D8.3 Report on TDR status and certification solutions for SSHOC repositories (Feb2022)

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			europe.org/platforms/interoperability/rirs), and associated badge schemes.	stewardship practices for value-added data" (May 2022)		
	Rec. 22: Use information held in DMPs	Although DMPs are not in the center, the work on the ENVRI-FAIR WP4 on policy harmonization touches on the issue. (e.g. D4.2 Policy landscape in ENVRI domain https://doi.org/10.5281/zenodo.3961475). However, the work on the ENVRI-hub also includes many of the more technical(i.e. standards) aspects in the development.				
	Rec. 23: Develop components to meet research needs	WP5 Common requirements and testbed for (meta)data services, community standards and cataloguing			Wp3/4/5 dvelopment of reserach tools	D9.1 Report on challenges user communities face when attempting to contribute to SSHOC WP7 SSH Open Marketplace - discovery platform for SSH resources
	Rec. 24: Incentivise research	This is an important aspect, but not really done within the ENVRI-FAIR as-is. There is some discussion on the Board of Env. Res. Infra leaders on the aspect, but clearly the main aspects are				

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	infrastructures to support FAIR data	done in the ESFRI and related projects (e.g. ERIC FORUM).				
18 May Pillar 4: Skills for FAIR						
Skills for FAIR (Pillar 4)	Rec. 10: Professionalise data science & stewardship roles	WP6 Training and capacity buildingD6.1 Inventory & gap analysis of FAIRtraining materials, https://doi.org/10.5281/zenodo.3885122 D6.2 FAIR training materials catalogue & integration with Common Training Platform, July 2021. Link to training catalogue: https://training.envri.eu /ENVRI-FAIR is also a partner of the LifeWatch ERIC Summer school, https://www.lifewatch.eu/home MS22 Training materials for the ENVRI datacenters are produced and available at the training portal https://doi.org/10.5281/zenodo.3903341 MS23 First face-to-face FAIR data management training event for ENVRI data centre staff completed	Set of training activities: https://www.eosc-life.eu/services/training incl. (i) knowledge exchange workshops; (ii) teaching researchers and clinicians how to share COVID-19-related data and software (planned); (iii) mentoring and Training opportunities for EOSC Research Infrastructures => Training Open Calls: https://www.eosc-life.eu/news/4-projects-awarded-funding-within-first-training-open-call terms4FAIRskills:	ESCAPE WP4 plans to run a community workshop for data providers on use of standards for publishing data, and sharing of best practices (Milestone expected May 2021). This will emphasise stewardship roles, and results will be presented in the ESCAPE Deliverable D4.8 "Final analysis report on use of IVOA standards for FAIR ESFRI and community data and best stewardship practices for value-added data" May 2022. **Update** May 2021 - due to covid and other delays the ESCAPE WP4 "Hands-on workshop for data providers" aimed at	Deliverable 8.2 Report on lessons learned and future prospects for adopting the e-learning platform at the PaNOSC facilities	These new professional roles are supported via training, see Rec. 11.

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	https://doi.org/10.5281/zenodo.3906126 **Updated**	https://terms4fairskills.github.io **Updated**	astronomy astroparticle physics data proviers, is re-scheduled for November/December 2021.		
Rec. 11: Implement curriculum frameworks and training	ENVRI-FAIR is offering training to different target groups in the community, passed webinars on FAIRsharing.organd on Semantic web and ontologies, for more details, see: https://envri.eu/home-envri-fair/ ENVRI-FAIR is also developing a training catalogue, as a common resource of open educational resources, https://trainingcatalogue.envri.eu/ ENVRI-FAIR is represented in the Training WP of the now starting EOSC Future project, where we will be involved in anumber of activities relevant to this Recommendation, including setting up a “Knowledge Hub” for EOSC (encompassing catalogue, training platform andassociated repository services).**Updated**	FAIR Cookbook, as specific FAIR 'training' online resource (via the FAIRplus, Elixir and pharmas driven project): https://fairplus.github.io/the-fair-cookbook => Webinar next week, May 26th: https://elixir-europe.org/events/fairplus-webinar-discovering-fair-cookbook webinar for an introduction to the FAIR Cookbook is here. The FAIR Cookbook is already on the EC Innovation Radar, and will feature in the upcoming version of the Guidance to Researchers by IMI (a joint private-public partnership by EC and EFPIA).**Updated**	ESCAPE has training activities throughout its program in all work packages, usually organised into specific training events. **Update** May 2021 - ESCAPE training events have included a school on "Science with Interoperable Data" (https://svo.cab.inta-csic.es/svoMeetings/index.php?mid=54&action=page&pagename=Meetings/SVO thematic_network/First_ESCAPE_School/Presentation) and there is also an upcoming ESCAPE summer School in 2021 (https://projectescape.eu/events/escape-summer-school-2021).	Deliverable 8.1 Report on lessons learned and future prospects for adopting best practises on data stewardship at the PaNOSC facilities. Deliverable 8.3 Teaching material for users of PaNOSC services, FAIR principles, and the PaNOSC facilities accessible in the e-learning platform at pan-learning.org	SSHOC D6.9 SSHOC Trainer Toolkit (draft) https://zenodo.org/record/3824755; D6.7 Inventory of existing learning materials https://doi.org/10.5281/zenodo.3596003; SSHOC webinars with LIBER and Trust-IT on 19 May about FAIRIfication in the scholix framework. https://sshopencloud.eu/training/training-events ; https://sshopencloud.eu/training

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12 May Pillar 5: Incentives and metrics for FAIR data and services						
Incentives and metrics for FAIR data and services (Pillar 5)	Rec. 12: Develop metrics for FAIR digital output	ENVRI-FAIR has performed a FAIR assessment exercise within WP5 with help of methodologies in GO-FAIR for the participatingRIs. The result of the assessment is currently being implemented in a common system, for more details see:D5.1 Requirement analysis, technology review and gap analysis of environmental research infrastructures https://doi.org/10.5281/zenodo.3884998 And Schultes E., Magagna B., Hettne K.M., Pergl R., Suchánek M., Kuhn T. (2020) Reusable FAIR Implementation Profiles as Accelerators of FAIR Convergence. In: Grossmann G., Ram S. (eds) Advances in Conceptual Modeling. ER 2020. Lecture Notes in Computer Science, vol 12584. Springer, Cham. https://doi.org/10.1007/978-3-030-65847-2_13 **Updated**		(added by F. Genova) ESCAPE WP4 participated in the tests of the RDA FAIR Data Maturity Model criteria. Astronomy has been developing well established FAIR practices and it was a useful test. The main aims for astronomy are Interoperability and Reuse, Find and Access are mostly in support to I and R. Finding is mostly a dynamic process.		
	Rec. 13: Develop	WP5 "Common requirements and testbed for (meta)data services, community standards and cataloguing" is working on	In ELIXIR, there are Core Data Resources and Deposition Databases (			D8.3 Report on TDR status and certification solutions for SSHOC repositories (Feb2022). T8.2 work will

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	metrics to certify FAIR services	this together with the subdomains in ENVRI-FAIR.The FAIR Implementation Profile approach (FIP) is a co-development with GO FAIR and described in Schultes E., MagagnaB., Hettne K.M., Pergl R., Suchánek M., Kuhn T. (2020) Reusable FAIR Implementation Profiles as Accelerators of FAIR Convergence. In: Grossmann G.,Ram S. (eds) Advances in Conceptual Modeling. ER 2020. Lecture Notes in Computer Science, vol 12584. Springer, Cham. https://doi.org/10.1007/978-3-030-65847-2_13 ENVRI-FAIR has participated in the FAIRsFAIR workshop series on how to assess the FAIRness of services. **Updated**	https://elixir-europe.org/platforms/data), which have been selected according to a set of indicators. There are also Recommended Interoperability Resources (RIRs, https://elixir-europe.org/platforms/interoperability/rir-selection) (FAIRsharing is one of), which are resources and services that facilitate FAIR-supporting activities, and also these have been selected according to a set of indicators.			include feedback to CoreTrustSeal Board on the CTS requirements.
	Rec. 25: Implement and monitor metrics	see input for Rec. 12				
	Rec. 26: Supp	TF5 Licenses citation and usage tracking (of data and VRE) (IR)				D3.2 Inventory of SSH citation practices, and choice for SSHOC citation formats and

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	ort data citation and next generation metrics					implementation planning, https://doi.org/10.5281/zenodo.3595964 D3.5 Report on integration and exploitation of citation and semantic annotation in SSH catalogues (August 2021)
21 May Pillar 6: Investment in FAIR						
Investment in FAIR (Pillar 6)	Rec. 14: Provide strategic and coordinated funding	The ENVRI Strategy is being updated at the moment, and the decision to work towards more permanent structure (via e.g. mutual MoUs or an Association) are investigated. However, most of the work is outside of the ENVRI-FAIR.		ESCAPE has a connection to the disciplinary networks of Astronomy and particle physics via their participation on the external advisory board. (ASTRONET, APPEC, NuPPEC, ECFA). ASTRONET for example is a consortium of the largest funding agencies for astronomy in Europe.		SSHOC exploitation plan and sustainability plan in the making - WP1, 2 and T8.1
	Rec. 15: provide sustainable funding	This aspect is considered in the ENVRI-FAIR sustainability work in WP1, but that work is just starting.In the subdomains (atmosphere, marine, solid earth, ecosystems) ENVRI-FAIR is working on sustainable data managementfor the contribution to the EOSCD8.12 Atmospheric			T 7.2 **Collection of the costs of DM at facilities**, ideally to analise cost drivers and identify. The cost collection should highlight what part of the cost is due to the FAIR DM and what are	T8.1 Governance & Sustainability (of the SSH part of the EOSC): D81. Governance and Sustainability Roadmap (Dec 2021)

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	subdomain development strategy, August 2022D9.10 Marine subdomain white paper for sustainable data management, December 2022D10.7 Final report on EPOS policies and governance for FAIR and EOSC, December 2022D11.4 Biodiversity and Ecosystem subdomain long term development and management plan, October 2022			additional costs of linking with the EOSC (e.g. costs associated to providing access to data and services to anyone, outside the embargo period).In T7.3 we are studying **business models** that allow to sustain the developments achieved in the PaNOSC project, after the end of the project. This involves also ExPaNDS, as we are similar facilities - always photon and neutron facilities, in PaNOSC we are ESFRI and ERICS, in ExPaNDS national facilities-. The business models will be validates with all the WP leaders of both projects and with the directors of the facilities. Finally, in T7.4 we will deliver our **sustainability plan**, where, according to the results of the validation of the business models, we will establish the needs and make	

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				proposals for the governance, funding streams and operation of the PaN (Photon and neutron) EOSC in the long term. Current status:T. 7.2 Refinig the cost collection, to be ready by mid June;T 7.3 Develpping business models, first validation with PaNOSC partners in June, with ExPaNDS to be agreed, with a group of directors of facilities within June 2021T 7.4 Studying possible governance structures, assessing the needs to maintain the operation of the current federated services (done), development of a long term strategy for the PaN facilities (to be done), studying and checking the feasibility of different funding streams, including in-kind contributions (ongoing).	
Rec. 27:	At the moment the ENVRI-FAIR coordination is organising a				

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	Open EOSC to all providers but ensure services are FAIR	workshop with other Cluster projects and EOSC Association + Commission on discussing this (and other) issues related to cluster roles in the EOSC.				