Table S7. Natural science category

Category		Natural sciences
	Physics and astronomy	Twelve disciplines in this subcategory has extremes from high 88% to low 21%. Particles fields physics and astronomy are frontiers in OA movement. Some technology-oriented disciplines such as spectroscopy and optics are low in OA. The amount of publication and available OA resources are huge (1.6 million OA articles in 22 years or 33.4% of total). (Suppl. table 5, Fig. 4, Suppl. fig. 4)
	Bioscience	Twenty-three disciplines are generally high in OA. Infectious diseases related subjects like microbiology and virology are the highest up to 76% in 2021. Other subject domains are relatively high but some technology-oriented sciences like microscopy and ornithology are low in OA (31-34% in 2021). The available OA articles during 22 years are 2.4 million or 45.6% of all. (Suppl. table 6, Suppl. figs 5-6)
	Chemistry	Nine disciplines in this subcategory was low in OA (21.4% in 22 years) but the recent trends in 2021 is increasing (41.0%). The proportion of OA in multidisciplinary chemistry is 58% in 2021. Some disciplines such as organic chemistry and inorganic nuclear chemistry are still low in OA (15.4 and 16.3% in 2021). The number of OA articles available in 22-year-period is huge (834.015 articles) but the proportion is still low (21.4% of total). (Supple. table 7)
	Mathematics	Five disciplines in this subcategory is high in OA. The number of OA articles available in 22-year-period is huge (637,140 articles or 44.4% of total) and the data in 2021 is even higher (54.6%). (Supple. table 8)
	Environmental	Four disciplines in this subcategory are high in OA. A total of 463,807 OA articles or 31.3% of total are available. (Suppl. table 9, Suppl. fig 7)
	Geoscience	Six disciplines in this subcategory is high in OA. Multidisciplinary geoscience is the highest (47.6% in 2021). The number of OA articles available in 22-year-period is 299,490 articles or 31.1% of total. (Supple. table 10)
	Agriculture, fishery, forestry	Eleven disciplines are high in OA and dairy animal science limnology and forestry rank high (35-47% in 2000-2021, 48-66% in 2021). The number of OA articles available in 22-year-period is 427,452 articles or 28.9% of total. (Suppl. table 11, Suppl. figs 8-9)
OA trends		Bioscience has overlapping features with healthcare and medicine and OA is well accepted particularly on those subjects related to infectious diseases. The general trend of OA is high in every subcategories and disciplines but individual variations are present. The discipline of astronomy/physics is a peculiar case. Researchers on high-energy physics initiated their own OA projects from astrophysics and since 2014, have made collective efforts on OA. The Sponsoring Consortium for Open Access Publishing in Particle Physics (or SCOAP3) covers more than 11 journals, books, and repositories. Chemistry and industry-oriented sciences are relatively lower in OA.
Library service plans		Special libraries on environment, agriculture, fishery, forestry will the great benefit from OA resources. Natural sciences like biosciences, physics and mathematics have good condition for library services using OA resources. Chemistry and geosciences have some limitation but the recent trend becomes better on OA availability.

A general summary of seven subcategories and their open access trends and possible plans for library services.